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No. 3

**ORIGINAL COMMUNICATIONS.**

(Original Communications are received with the understanding  
(that they are contributed exclusively to THE LARYNGOSCOPE.)

**ON THE USE OF RADIUM TO EFFECT AN ATROPHY  
OF PHARYNGEAL LYMPHOID TISSUES—  
A TOPICAL REVIEW.**

DR. SANFORD WITHERS, Denver.

It is to be regretted that more of the competent laryngologists have not undertaken the investigation of the use of radium to effect an atrophy of tonsillar and adenoid tissue.

In order to keep the chief points in mind, it will be profitable to briefly review the embryology, anatomy, physiology and pathology of the tonsil.

*Embryology and Anatomy*<sup>1</sup>—The development of the tonsillar ring begins in foetal life. Encircling the opening of the pharynx, lying in the mucous membrane is a ring of lymph follicles, sometimes called the ring of Waldeyer. Certain parts of the ring become well defined, lymphoid structures, of which four are of importance:

1. The tonsil at the apex of the ring in the pharyngeal vault.
- 2 and 3. The two lateral masses of tonsillar tissue between the pillars of the fauces.

4. The single lingual tonsil at the base of the tongue.

Other parts of the ring are represented in scattered islands of lymphoid tissue about the Eustachian tubes, in the fossae of Rosenmuller and along the lateral folds of the pharynx. During the second decade of life, the upper part of the ring tends to retrogress and the lower portions remain, though becoming gradually smaller as a rule.

The crypts of the tonsils are developed from invaginations of the epithelium and vary in size from almost microscopical ducts to the large subdivided pockets of the faecal tonsil. Around these crypts lymphoid tissue is built up, and between them interstitial connective tissue extends to the supporting mucous membrane.

*Physiology*—The physiology of the tonsillar ring has long been a mystery. Its position in the portals of the mouth and nose, its constant presence, its periods of growth and involution suggest that it may have a definite function, acting complementary to, or in the same manner as lymphoid tissue in other parts of the body. The physiological function usually ascribed to it, is that of protecting

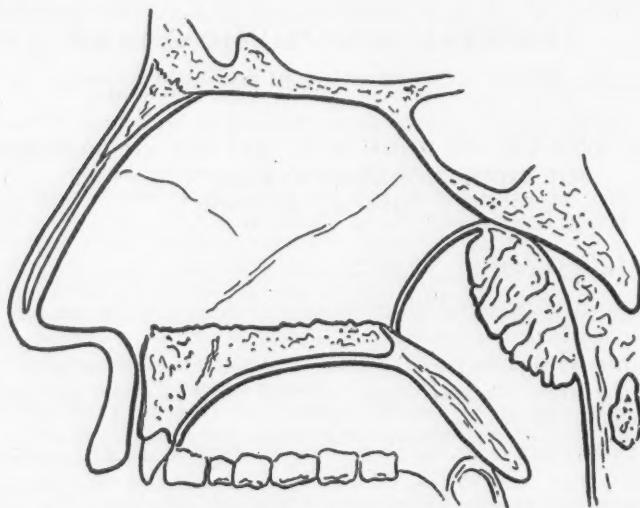
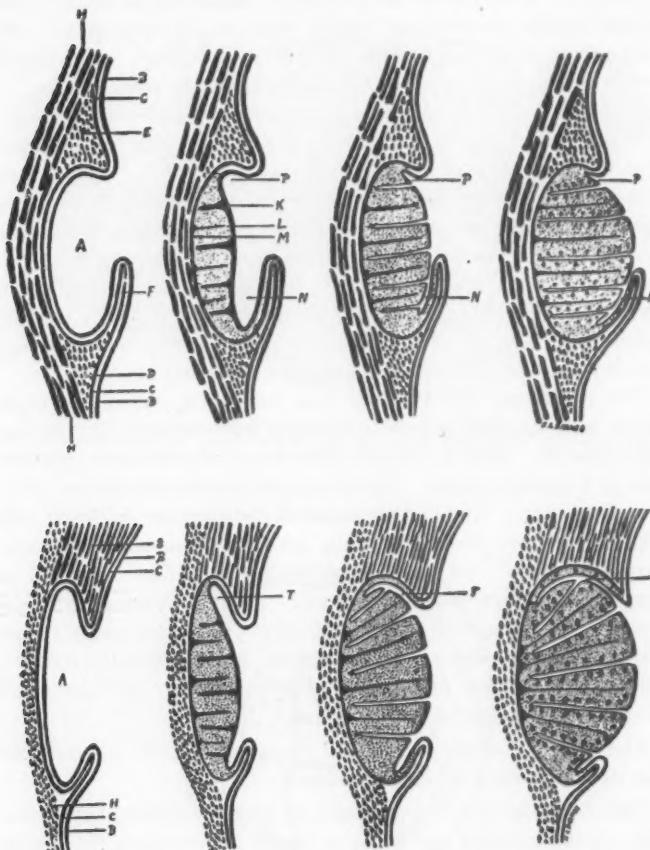


Figure 1. To show the relative size and position of the pharyngeal tonsil in the vault of the pharynx.

the body against infection, especially in childhood. It is possible that pathogenic bacteria caught in its crypts may stimulate the body's immunizing agents against systemic infection by like organisms. Yet the removal of large amounts of this tonsillar tissue has not been shown to produce any decided ill effects, on the contrary it is taken away to the advantage of the patient in practically all of its diseased conditions. *No operation can remove all of the lymphoid tissue in the pharyngeal mucous membrane, and when the excision of large amounts is done in early life, the outlying parts of the ring appear to be stimulated to growth and hyperplasia.*

## THE TONSILLAR RING.

TAKEN FROM COOLIDGE.—DISEASES OF THE NOSE AND THROAT.



Figures 2 and 3. Diagrams illustrating the development of the tonsil (Barnes). The left-hand figure in each row represents the sinus tonsillaris at the fourth month of foetal life before the appearance of tonsillar tissue. The succeeding figures show the gradual development of the tonsil and explain the relationship which it assumes to the surrounding tissues. The upper four figures are in cross section and show the development of the tonsil and plica. The lower row, in longitudinal section, shows the development of the tonsil and the formation of the supra-tonsillar fossa. A, Sinus tonsillaris; B, Faecal epithelium; C, Fibrous mucosa; D, Muscle fibers of anterior pillar; E, Posterior pillar; F, Plica triangularis; H, Superior constrictor of the pharynx; K, Epithelial bud—the anlage of the crypt; L, Fibrous trabecula springing from M—the capsule; N, Anterior fossa; P, Posterior fossa; S, Muscle fibers; T, Supra-tonsillar fossa.

The great majority of children have more adenoid tissue in the vault and faucial tonsils than is generally supposed. The pharyngeal tonsil is present and of considerable size up to the age of nine to twelve. After the age of 25 to 30 it should not be visible. The faucial tonsils, in childhood, weigh from two to three grams each, and persist much longer than the pharyngeal tonsil. The lingual tonsil develops last of all and is quite variable in size.

*Histology*—Lymphoid tissue constitutes the bulk of the tonsil, covered by soft, moist, entodermal epithelium, resting on a connective or reticular tissue layer. The *tunica propria*. A structureless basement membrane is often present immediately beneath the epithelium. The epithelium, basement membrane and tunica propria, constitute the mucous membrane, and in dissection, would be stripped off as a single structure. Beneath the mucous membrane and attaching it to the underlying, deep structures is a very vascular connective tissue, which forms the capsule of the organ and through which it sends trabeculations to mucous membrane.

The epithelium of the tonsils is a stratified epithelium of many layers, with flattened cells on its smooth free surface, and columnar cells beneath. This epithelium lines from ten to twenty *tonsillar pits* or *fossulae* (crypts). These are irregularly tubular and often branched. Many lymphocytes penetrate between the epithelial cells and escape from the free surface into the saliva becoming "salivary corpuscles." In places, the tonsillar epithelium is so full of lymphocytes as to appear disintegrated. In the reticular layer of the tunica propria, especially about the crypts, there are many lymph nodules, some of which are well defined, with germinative centers, but many others are fused into indefinite masses. This lymphoid tissue constitutes the bulk of the tonsil.<sup>1</sup>

The structure of the lingual and pharyngeal tonsils is much like that of the palatine or faucial tonsils.

*Pathology*—In certain cases such as acute tonsillitis, hyperkeratosis, (parakeratosis) and often in simple hypertrophy, the faucial tonsils participate in the general disturbance of the whole ring. In more indefinite infections, the relatively poor drainage of the crypts and the large mass of the faucial tonsils make them more often the seat of pathological processes than is the case with the rest of the ring.

Diseases of the tonsils may be grouped into acute and chronic, the former including acute tonsillitis, peritonsillar abscess, and those cases of acute local infection, such as diphtheria, Vincent's angina,

etc. The chronic diseases include hypertrophy, keratosis (or parakeratosis) and cases of periodic hyperplasia or septic absorption. If the tonsil allows infection to pass through it into the sys-



Figure 4. "Diagram of a section of a faecal tonsil, showing crypts, follicles and capsule. This tonsil is of the submerged type and the crypts irregular and dilated." (Coolidge.)

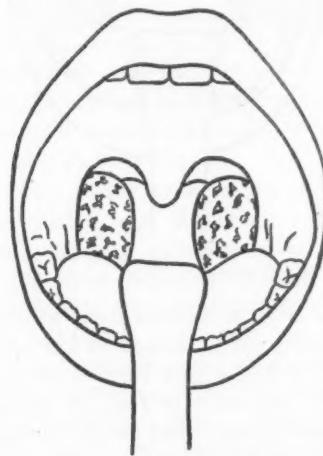


Figure 5. Large prominent tonsils.

tem or, if mechanically, it is obstructive, it must be looked upon as pathological. Syphilis, tuberculosis, sarcoma and carcinoma are rather uncommon pathological processes of the tonsil.

Coolidge<sup>2</sup> states as follows:

1. "Tonsils should be removed if serious symptoms can be logically attributed to them. The more serious the symptoms and the more direct the connection, the more imperative is the operation.
2. "They should be removed for recurring peritonsillar abscess.
3. "They should be removed for recurring and persistent cervical adenitis that cannot be accounted for by a focus in the teeth, vestibule, scalp, nose, naso-pharynx or ears.
4. "They should be removed for recurring sub-acute tonsillitis.
5. "They should be removed if it is believed or even seriously suspected that they are the entering point of constitutional infec-

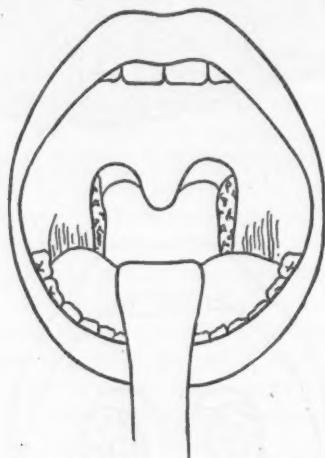


Figure 6. Tonsils of the same size as in the proceeding figure, but submerged or buried in the palate.

tion. It is perhaps better to sacrifice many innocent tonsils rather than to allow one guilty one to escape, but it is also true that every unnecessary operation does a little harm to medical science. It is unfortunate that we can never be sure, by its appearance that a tonsil is innocent, and not very often that it is guilty.

6. "Very large tonsils should be removed, as experience proves that persons are better off without them.

7. "Tonsils which are wholly exposed may be obstructive and require removal in that account irrespective of size. It is generally the deeper portion that is the more important to remove.

"Tonsillectomy should be looked upon as a serious operation. As in the majority of cases, patients undergo the operation with little disturbance, and the results are apparently all to the good. The removal of the tonsils is not infrequently advised with the feeling that the operation is insignificant, and that the tonsils are in themselves a disease. Complications may occur in tonsillectomy, and the convalescence may be very slow."

Regardless of its future as a therapeutic agent, one of the permanent contributions of radium therapy has been the demonstration of certain biological properties of tissues which were previously unrecognized. It was observed that certain tissues were *resistant* to even large doses of radiation, while others were quite *susceptible* and underwent resolution or retrogression with remarkably small units of beta, gamma or X-rays.

In general, the structural characters, which determine susceptibility to radiation are a cellular nature; undifferentiated form of cells; hyperchromatic nuclei; rapid growth with abundance of mitoses; vascularity, especially when due to an abundance of delicate capillaries; and absence of much inter-cellular substance. (Ewing<sup>3</sup>). It was the presence of this histological picture, wholly or in part, in malignancies which responded quickly to radium that lead certain authors to assert that radium was selective in its action for certain types of cells.

Satenstein and Remer<sup>4</sup> state that, "Acute and subacute inflammatory tissues are characterized by lymphocytes—round cells. They are the least resistant of all pathologic cells and are the most readily influenced by therapeutic measures."

On the other hand, tissues prove relatively insusceptible when the cells are differentiated, adult in type and contain small amounts of chromatin in the nucleus; when they grow slowly, and mitoses are few; when the blood supply is through well formed adult vessels; and when there is much intercellular substance. (Ewing<sup>3</sup>).

How do X-rays and gamma rays act on living tissues? Regaud<sup>5</sup> states that the little penetrating, and therefore readily absorbed, rays have a general caustic action, but the more penetrating rays have an "elective cyto-caustic action." There is a long range of radio-sensitivity for animal cells, ranging between the most radio-sensitive (such as certain sex and leucocytic cells), and the least radio-sensitive (such as muscle fibers and nerve cells). The radio-sensitivity, too, is a property of the nucleus, and is inherent in certain states or temporary physiological periods of cell life, the most

important and best known of which is the state of reproduction. Arguing from these premises, Regaud<sup>5</sup> asserts that X and gamma rays of very short wave length are elective poisons for nuclear chromatin. Hence, the rays suppress or suspend reproduction in lymphoid tissue, which is likewise shown to be highly radio-sensitive. Adult connective tissue and epithelial cells stand much lower in the scale of radio-sensibility (more resistant) than leucocytic elements and young endothelial cells and fibroblasts.

It should, therefore, be possible to produce a marked retrogression of lymphoid and leucocytic elements in tonsillar tissue without causing a solution of continuity of the connective tissue elements.

Murphy, Witherbee, Craig, Hussey and Sturm of the Rockefeller Institute<sup>6</sup> made a joint study of a series of forty-six cases of diseased tonsils, treated with fairly well filtered X-rays, and proved that they could:

1. Bring about a definite diminution in the size of the hypertrophied tonsils,
2. That with such atrophy there was evidence of less occluded debris in the crypts with,
3. A diminution in the exudate and sepsis, particularly in reference to hemolytic streptococci,
4. Without producing undue reaction either constitutionally or locally.

These authors do not infer that the X-ray producing the lymphoid atrophy has any bactericidal action.

Their method is open to the criticism that the rays must penetrate more than an inch of normal tissue to reach the target, in the case of the faucial tonsils, and two to three inches in raying the adenoids through the back of the neck, with the consequent loss in intensity, and dispersion. The probability of temporary or permanent epilation and cutaneous atrophy of the area of the skin portal is not remote. There is some danger of unfavorable effect on the parotid gland, the lower pole of which is traversed in such treatment.

Paccini<sup>7</sup> reported, favorably, a method combining the use of ultra violet-rays to the surface of the tonsil supplemented by X-ray following the Murphy-Witherbee<sup>6</sup> technique; claiming that there was a direct bactericidal effect of the ultra violet-rays in the surface layers of the tonsillar epithelium. A serious doubt is raised in the minds of many, that the depth of penetration of such ultra violet

rays below the surface is not sufficient to cause a sterilization of the crypts. The method is open to the criticism that such treatments must be repeated time and time again.

Many other reports of the use of X-rays in the treatment of tonsillar hypertrophy have appeared, but without adding materially to the data above given.

A brief review of the bactericidal effect of beta radiation is here indicated, in view of the fact that there is prevalent among many physicians the opinion that such rays have little, if any, sterilizing properties.

It is sufficient to quote the very responsible authors, Colwell and Russ<sup>8</sup> and Chambers and Russ<sup>9</sup>, on this point.

"SHOWING TIME REQUIRED FOR STERILIZING EFFECT PRODUCED BY  
0.5 MILLI-CURIE PER CUBIC CENTIMETER."

Organism		Time
B. coli communis	.....	1 hour 5 min.
Staph. aureus	.....	2 hours 0 "
B. pyocyanus	.....	3 " 10 "
B. anthracis	.....	3 " 20 "
B. tuberculosis	.....	4 " 0 "

"The number of organisms in the suspension was approximately one million per cubic centimeter."

Quoted from Colwell & Russ, "Radium X-rays and the Living Cell," page 146.

Recently the practical application of this bactericidal action of beta rays has been demonstrated by Marshall<sup>10</sup> in sterilizing apical abscesses by the injection of even such small amounts as .06 to .08 milli-curies of emanation and sealing the canal. Bacteriological examination of the treated canals showed sterility in 85 per cent of the cases.

There is no evidence to show that infection which has been introduced in buried tubes of emanation has persisted. In fact, the necrotic tissue surrounding such buried tubes, (which would make an ideal culture media), has repeatedly been shown to be sterile.

Bagg<sup>11</sup> has shown that upon embedding from .5 to 1.0 milli-curie in tiny capillary glass tubes in muscle (radio-resistant tissue), there is produced a zone of necrosis of about 5 millimeters in radius, about such a spicule. The necrotic center is surrounded by a zone of intense leucocytic infiltration, in which is carried on active phagocytosis. The destroyed cells in the center are generally absorbed without infection or surface sloughing.

## ABSTRACTS OF ARTICLES DEALING WITH THE USE OF RADIUM IN THE TREATMENT OF TONSILS.

It is a singular coincidence that the first physician to use radium therapeutically, (Reported by Chase)<sup>12</sup> in this country, (1900) and also, the first to use radium within the mouth to effect an atrophy of hyperplastic tonsillar tissue are the same; Francis H. Williams, M. D., of Boston. The first record of a design for a tonsil applicator, and the use of radium in a series of cases, was made by Doctor Williams<sup>13</sup> in March, 1921.

The following is an abstract of Doctor Williams<sup>13</sup> preliminary report in his own words:

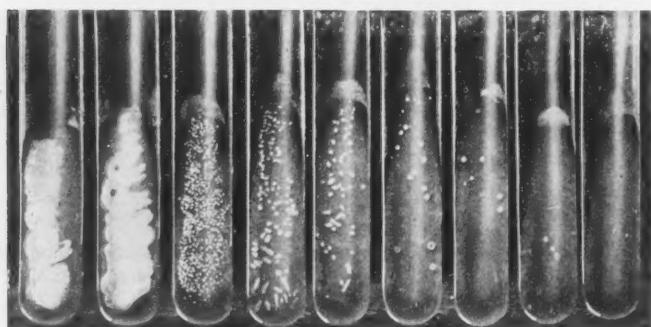


Figure 7. To show the Action of Beta Rays on *Staphylococcus Pyogenes Aureus*. (Colwell and Russ.)

"The rays from radium cause a retrogression in the growth of lymphoid tissues, of which the tonsils and adenoids are made up to a large extent, and can be applied directly to the tonsils and adenoids, and neighboring parts being protected by lead, that is to say, the radium container is covered with lead except on the side through which is desired that the rays should issue, allowing the maximum radiation to reach the tonsils and adenoids, and the minimum other parts.

"I have used 50 milligrams of bromide of radium," (radium bromide contains approximately 53 per cent of radium element, so that the amount used here would approximate 26 milligrams of radium element), "in a flat container, with the rays filtered by 0.83 millimeter of aluminum, held directly against or near the tonsil. The radium should be withdrawn every few minutes, or as often as is comfortable for the patient, until the total exposure of 15 minutes,

more or less as required, has been reached. Improvement follows promptly, but the ultimate results may be expected only after some weeks. Guided by more than 17 years' experience in the use of radium, it seems to me better not to attempt complete healing by one treatment, for the present at least, but rather to give two or perhaps three treatments as patients and conditions differ.

"It may prove more convenient to use a container by means of which both tonsils may be treated at the same time. I have devised one to be held midway between the tonsils, which consists, in general, of a disk of lead, (not more than 2 centimeters in diameter and about 1 centimeter thick, more so in the middle), with a hole bored through its center, somewhat flared at each end, for the exit of the rays, and another bored from the outer edge radially

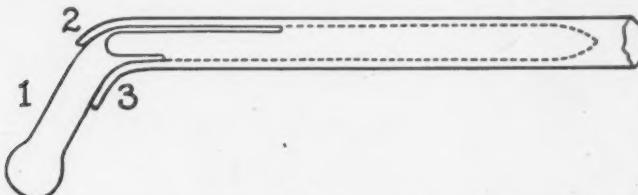


Figure 8. Design of applicator suggested by Doctor Williams for treating both tonsils at the same time. Below 1. is a small bulb at the end of the bent portion of a glass tube, for containing the radium. The straight end is inserted into a metal handle about 30 cm. long, of which only 7.5 cm. are shown, by lifting the spring at 2, and is held in place by a narrow strip of plaster wound around the glass and metal between 2 and 3. The radium is kept in position in the bulb by stuffing the tube with spun glass, and more spun glass is pushed in until the tube is nearly filled, the end being closed with a cork, instead of sealed off as shown in the cut. An aluminum cap, to act as a filter, is slipped over the bulb and then the bulb and bent portion of the tube are enclosed in sheet lead, except the lower end of the bulb. The lead should extend more or less beyond the bulb, according to the size of the area to be treated.

to a little beyond the center. The tube containing the radium may be slipped into this end and the opening afterwards closed by screwing a metal handle part way into it. The uvula, the back of the throat, and parts behind it are thus protected by about 1 centimeter of lead. When treating one tonsil only, the opening towards the other may be closed with a plug of lead. Appropriate filters should be used.

"Before applying the radium the throat should be moistened with a suitable solution of cocaine to prevent gagging from the insertion of the container. All instruments should be covered with two thicknesses of rubber, and for this purpose, two rubber finger cots are stretched over them and far down on the handle, where they may be secured by a strip of plaster.

"For the tonsils, radium, if properly used, I consider the safest, and that it will probably prove to be the best treatment for many patients.

"While not coming within the title of this paper, it is noteworthy that after treatment by radium, I have observed striking improvement in acute and sub-acute tonsillitis."

Simpson<sup>14</sup>, of Washington, D. C., reported a series of cases treated by means of, "a flat dermatological, 30 milligram, double strength radium applicator (plaque). covered with only a single layer of sterile rubber tissue." "A convenient handle is supplied with the applicator which enables the patient to hold the unscreened radium directly on the tonsils for an hour. With this original technique, it is perfectly remarkable how quickly the tonsil begins to shrink and show other atrophic changes. A mild reaction which

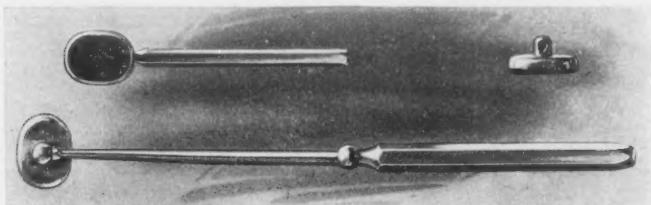


Figure 9. Plaque applicator faced with 1 millimeter of Redmanol containing 30 milligrams of radium element designed by Doctor Simpson<sup>14</sup> to treat hypertrophied tonsils.

turns white, is to be seen where the radium has been held. This slight irritation of the tonsil disappears in two or three days." "Swabbing the throat and tonsil with a two per cent novocain solution will usually eliminate any gagging."

"By using the unscreened radium applicator on the surface of the tonsil, combined with three points Hampson X-ray three millimeters aluminum pastile on the skin, and covered with two layers of chamois skin externally, I get a cross-fire of radium and X-rays which is concentrated and centered on the tonsil itself." Simpson states that he is positive that he can cause the complete atrophy and disappearance of any but a *fibrous tonsil*, in from one to three treatments. In his article, he neglects to mention the exact radium or X-ray technique used, it is inferred, however, that the radium applied is about 60 milligram hours to each tonsil. The accompanying illustration, Figure 9, shows the applicator that was designed by Doctor Simpson for treating the tonsils.

In a personal communication, Mr. C. F. Whittemore, a radium physicist, has submitted the accompanying photograph, Figure 10, of an applicator for utilizing chiefly beta radiation to treat tonsils. I am assured that such an applicator will not screen off more than 50 per cent of the available beta rays, which is about equal to a plaque faced with .4 millimeter of aluminum.

The advantages claimed for such an applicator are, that in it may be placed the glass capsules containing the radium salt or emanation as used in tubular applicators, which permits the passing of about 100 per cent more beta radiation than would be available through .5 millimeter of silver.

Wells<sup>15</sup>, of Washington, D. C., also reports a series of cases of hypertrophied tonsils treated with radium. In a personal communication, he states that the technique usually followed is to embed

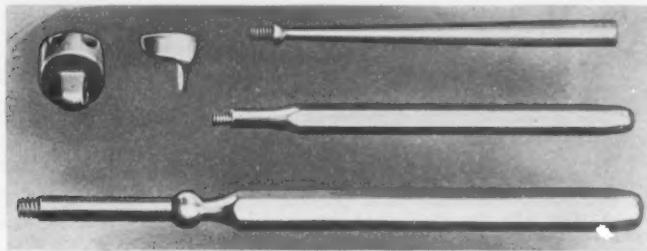


Figure 10. Applicator plaque for holding two glass capsules of radium to treat tonsils. The only screening interposed between the glass radium containing tubes is 0.1 millimeter of monel metal. The openings in the plaque are closed securely by placing the guard (seen just to the right of the plaque in the illustration), in position and inserting the handle, holding the two parts firmly together.

into each tonsil three 10 milligram needles, from above downward, leaving them in position from one to two hours. In other words, it requires about 60 milligram-hours to produce an atrophy of the average tonsil, when needles are embedded directly into its substance.

In regard to the effect he states as follows:

"For the purpose of comparison, it has been my habit to begin always with the larger of the two tonsils, and the effect is always impressive when at the next sitting we observe that the proportion is reversed and that the previously larger tonsil has now become the smaller one. In addition to mere reduction of size, a decided difference is remarked in the appearance of the organ. A tonsil that previously presented an irregular, nodulated surface, or perhaps

has been of the so-called ragged or spongy type, now appears smooth, firm and pale. Very important proof that the atrophic process has successfully attacked the diseased lymphoid structure, is found in the progressive lessening of colonies of bacteria, and especially the fact that we can no longer obtain pathologic exudate from the crypts on pressure."

Most of the standard needles, containing ten milligrams of radium, are from 25 to 29 millimeters in length and have the radium packed into a space in the barrel, of about 8 to 10 millimeters nearest the point. In order, then, to have that portion of the needle containing the radium in contact with the tissue it is desired to effect, it is necessary to have the point of the needle penetrating 3 to 5 millimeters beyond.

A very complete review of the tonsil by Keiper<sup>16</sup>, but without bibliography, passes of irradiation treatment of hypertrophied tonsils, with the statement that, "This certainly ought to be tried out, for it may prove to be a very valuable method."

The particular advantage of radium, in direct contact with tonsillar tissue over X-ray applied from without, lies in the fact that with a given quantity of radium or emanation, the quantity of radiation is not so variable, and use can be made of beta rays which have a direct bactericidal effect and do not have enough penetration to cause any destruction of the neighboring structures.

With this in mind, the writer would like to suggest that men who have emanation available try with him, the use of bare tubes containing 0.2 to 0.3 milli-curies buried in the tonsil, one such spicule for approximately one cubic centimeter of the bulk of the tonsil. In cases of moderate sized tonsils, 0.2 to 0.3 milli-curies embedded in the upper and lower poles of each tonsil is advised.

The introduction of bare tubes of 0.3 millimeter in diameter and 3.0 millimeters in length is easily accomplished by means of the tiny trocar-stylette introducer, herewith illustrated. (Figure 11). It is only necessary to swab the surface of the tonsil with a cotton wound applicator moistened in 1:1000 adrenalin and dipped in cocaine (hydrochloride) crystals. The operation of inserting the bare tubes should not take more than five minutes and the patient is not in the least discomfited.

Such an application makes use of the maximum of beta radiation with the least possible destruction or injury of neighboring tissue.

In the course of time and with sufficient dosage, (repeated if necessary), it is certain that we can obtain an atrophy of the tonsil,

which we may liken to the normal physiological retrogression, and that all local evidences of disease disappear.

We need one further evidence of the value of this method; namely, the disappearance of systemic involvements of varying character, that are known to have had their origin in tonsillar disease. This appears, from limited observation to be true, but more experience is necessary before one may speak of this phase of the subject with a proper feeling of conviction and authority.

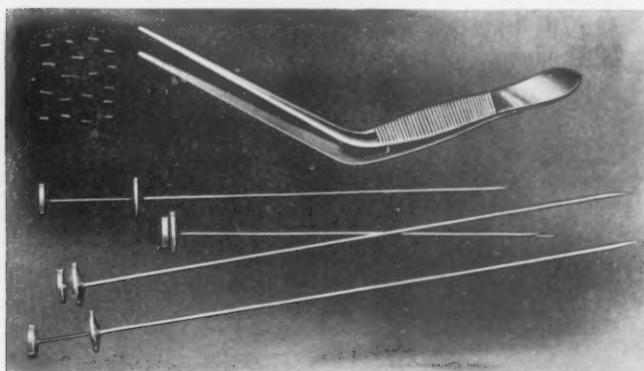


Figure 11. Bare tubes of emanation (spicules) forceps and introducer (trocar-stylette), for embedding bare tubes of emanation subcutaneously.

#### SUMMARY.

1. We have briefly reviewed the Embryology, Anatomy, Physiology and Pathology of the lymphoid tissue of the pharynx.
2. That "it is better to sacrifice many innocent tonsils than to allow one guilty one to escape" surgery, and that the operation is not insignificant or free from complications.
3. That no tonsillectomy can remove all of the objectionable lymphoid tissue in the pharyngeal mucous membrane, and when the excision of large amounts is done early in life, the outlying parts of the ring appear to be stimulated to growth.
4. Regardless of its therapeutic properties, the demonstration of certain biological properties of cells by radium has been a permanent contribution to science.
5. That tonsillar tissue is probably one of the most "radio-sensitive" tissues of the body.

6. That it is possible to produce marked retrogression in leucocytic elements and tonsillar tissue with X-rays and radium.
7. The use of radium in affecting an atrophy of tonsils is not new and that its use is founded on sound biological principles.
8. Suitable means of application have been devised.
9. That the use of radium to treat hypertrophied tonsils is superior to the use of X-rays in that its use entails none of the possible dangers.
10. Radium has the advantage in that its radiation is constant. It may be distributed in plaques, tubes, needles or bare tubes of emanation which may be applied directly where the effect is desired without injury to the surrounding parts; and that, in certain forms of application, use may be made of beta radiation which has a decided bactericidal effect.

With all due allowance for ethical practices and conservatism, the fact remains that our patients are demanding that they be more fully taken into consideration as individuals and not as cases, and that they be subjected to lines of treatment based on natural laws. Blind indeed is the physician, specialist or general practitioner, who has not sensed the unmistakable awakening to a fuller realization of the truths of his science, as at present understood, based on rational knowledge of the basic subjects of our medical studies.

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## HISTOLOGICAL CONTROL OF RADIUM TREATMENT IN CARCINOMA OF LARYNX.\*

DR. JAMES G. CALLISON, New York.

Radium emanations will eradicate lawless growths only in so far as they possess the power to devitalize vital tissues. I think this statement will meet with immediate acceptance. In the treatment of new growths with radium, therefore, the question is, "Which tissue possesses the greater amount of vitality." Penetrating rays, either radium or X-rays, are not so kindly considerate that they will destroy the tissues we do *not* want and leave us the one we *do* want. When penetrating rays are permitted to enter the body at any point, their stimulating or destructive effect is exerted on every cell with which they come in contact. Up to a certain point, the effect of the application is stimulating, but when that stimulation becomes too great for the cell to endure, the cell dies. In other words, the cell is caused to perform a great amount of work, and if the stimulation is too great, the cell dies from exhaustion. The effect of the application of these rays cannot, from the very nature of their application, be immediately destructive.

If cells A and B are placed side by side in the body, and it is desired to destroy cell A by penetrating rays and leave cell B intact, then cell B must have the greater vitality, and this difference must be such that after cell A has been destroyed, cell B can still recover from the damage done to it. If cell A has the greater vital resistance, then cell B will be destroyed and cell A will remain viable, the effect being just opposite to that desired.

When these rays, properly screened, are permitted to enter the body, they are presumed to exert an equal effect on the skin and for a considerable distance beneath it, and there are some reasons to think the destructive effect on different types of cells is not widely different. When epithelial cells have reverted to an embryological form and have taken on embryological activities, there is every reason to think that their vital powers have been increased, and that they have increased resistance to destructive agents. If this presumption is true, then the connective tissues, or supporting framework of the lawless growth should suffer more

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\*Read before the Medical Society of the State of New York, Brooklyn, May 5, 1921, as part of the discussion of Papers on the Use of Radium in the Treatment of Cancer of the Larynx.

from exposure to the radium emanations than the tumor cells themselves.

My first opportunity to study this question histologically was, in a case which I had the privilege of observing with Dr. T. Lawrence Saunders, in the summer of 1918. The patient presented a basal cell epithelioma of the auricle, located at the lower end of the anti-helix, where the layer of integument covering the cartilage is very thin. This new growth was subjected to a course of radium treatment that at the time seemed adequate, but without result. Before doing a partial amputation of the auricle, a section of the tumor was removed and submitted to histological examination. I had the privilege of examining the sections, and formed the opinion, or impression, that there was an atrophy of the connective tissue without any very marked effect on the carcinomatous structures.

More recently, through the kindness of Dr. Henry Lowndes Lynah, I have had the opportunity of studying the effect of the applications of radium in a case of carcinoma of the epiglottis. Mr. J. T. has been under observation for almost one year, and the successive histological reports on specimens from the new growth are appended. The superficial location of these two carcinomas makes them particularly suitable for radium treatment, and the results can be judged beyond question. It seems to me that I am justified in suggesting that enthusiasm for radium treatment should at least, be held in abeyance for the present.

The reports follow in order:

— I —

June 30, 1921.

Dear Dr. Lynah:—I have examined the tissue removed from the epiglottis of Mr. J. T., and find present a great amount of cancerous tissue. Judging by the intensity of the staining reaction of these cancer cells, I believe them to be decidedly viable. The nests of cancer cells are not necrotic, but rather they appear atrophic. This atrophic appearance applies to the connective tissue cells and the cartilage in the tissue as well. I think these cancer cells may be rendered dormant or latent, but I am not willing to concede that they have been rendered harmless, by any means. The normal tissue seems to be as much affected by the cauterant effect of the radium emanations as are the cancer cells. Your patient will need more radium, or something, to cure him.

— II —

August 10, 1920.

Dear Dr. Lynah:—I have examined the tissue removed from the epiglottis of Mr. J. T., and compared it with the last specimen removed.

There is a decided improvement in the appearance of the tissue, both in the reduction of the cancer nests, and in the increase in the fibrous elements of the tumor. There is also a decided reduction in intensity of the staining reaction of the cancer cells. They stain but little more intensely than normal epithelial cells. In spite of these facts, however, in my opinion, there are still viable tumor cells in the tissue, and I see no reason to believe that they would not spring into activity if treatment were now discontinued. Some of the cells that present an appearance of viability are superficial, being located just beneath the epithelial covering of the part.

## — III —

November 18, 1920.

Dear Dr. Lynah:—I have examined sections from the tissue from the throat of Mr. J. T. There are, in the sections, two pieces of tissue. One is small and round, the other a little larger and more ovoid, tapering to a sharp point at one end. This larger piece seems to be taken from normal tissue, except that there is a slight round cell infiltration, probably due to the radium burn. The smaller piece seems to me to have been taken from a part of the original cancer growth that was not removed. There are numerous nests of cancer cells in a more or less advanced state of atrophy. Some of these, however, retain the ability to stain intensely and the cell outline is well retained, so that there seems to be considerable vitality left in them. In other nests, the staining reaction is less intense, and the nuclear body lacks the usual sharp outline. I am of the opinion that Mr. J. T. should have more radium treatments.

## — IV —

January 26, 1921.

Dear Dr. Lynah:—I have examined sections from the fourth specimen from the larynx of Mr. J. T. This last specimen shows a decided increase in the carcinomatous infiltration of the tissues. There is an increased number of cell nests and there is increased crowding and infiltration in the tissues. It almost appears as if the radium were causing an atrophy and shrinking of the connective tissue of the area, rather than having an effect on the carcinoma cells. The cells within the nests show an increased intensity of the staining reaction and an increased number of mitotic figures in the growth. Withal, there is every indication of an increasing malignancy in the carcinomatous growth, in so far as this can be judged by the sections and the microscopic picture they present on this examination.

## — V —

March 28, 1921.

Dear Dr. Lynah:—The last specimen of tissue from your patient, Mr. J. T., has been examined. There are many undoubted nests of cancer cells in this tissue, those showing the least disturbance being close beneath the surface epithelium. The whole tissue shows a very marked disorganizing effect from the radium, and there is nuclear fragmentation, both in the cancer cells and in the connective tissue cells, and there

is a general process that is apparently atrophic in nature going on throughout the structure. As there are still undestroyed cancer cells at the direct point of application of this enormous dose of radium (41 milligrams of radium in three unscreened needles), I feel sure that the deeper tissues will show more marked evidence of the infiltration of the malignant growth.

#### DISCUSSION.

The two cases of cancer, herein presented, were both particularly well situated for the application of radium, both being superficial and one backed up by a layer of cartilage. Both were treated efficiently according to the standards then in vogue, and according to the judgment of the men administering the radium. In both cases, the treatments were without curative effect as judged by histological standards. In both cases, the treatments had a greater effect on the supporting connective tissues than on the cancer cells themselves. This leaves open to serious question, the oft repeated statement, that radium and the X-rays have a selective action for new growths. It would seem to point to the conclusion that, in order to destroy a cancerous growth with these agents, it will be necessary to destroy the part concerned in the cancerous growth.

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Note.—Mr. J. T. has drifted out of the care of Dr. Lynah. A recent inquiry through his family brought the information that his condition was "about the same" on October 15, 1921.

206 East Seventeenth Street.

## A STUDY OF THE RINNE TEST IN ONE HUNDRED CASES.\*

DR. ROBERT SONNENSCHEIN, Chicago.

It was in 1885 that Dr. A. Rinne described his test. At first he placed the fork on the upper incisors and when no longer heard, tried the hearing of the fork by air conduction and found that it was longer than by bone; that is to say, positive. He found that when the fork was placed on the lower incisors it was heard somewhat longer via bone conduction than through the upper incisors, due, he believed, to the peculiar form of the lower jaw and the proximity of the joint to the ear. Rinne stated that this test is useful in establishing the diagnosis in cases of nerve deafness. "If the findings are the same in the hard of hearing as in the normal, we consider, and rightly so, that the relation between the sound conducting power of the cranial bones and the complicated acoustic apparatus is normal, and that, therefore, the nerve of hearing must be affected. Conversely, if the patient hears via bone as long or even longer than via air, we decide that disease of the conducting apparatus up to and including the oval window is present." Rinne points out that this test which, like so many others, depends upon the patient's subjective observations, can give information only in the more intelligent persons.

Bezold placed the  $a^1$  fork on the mastoid bone and found that in middle-aged persons it is heard on an average of 10 seconds, and he believes that the air conduction is generally about 30 seconds longer than the bone in the normal positive Rinne when this fork is used. However, in one of his papers on the functional testing of the ear, he states that when the fork is held only at the meatus auditorius, without having been previously placed on the mastoid, the duration of air conduction is longer than when the usual Rinne test is carried out; in fact, it then lasts 70 to 80 seconds. This is, of course, due to the fact that when the stem of the fork is pressed against the bone the excursions of the instrument are interfered with, and the duration of vibration thereby shortened. In another article he calls attention to the fact that when the Rinne test is carried out in the usual manner, and the fork no longer heard with the prongs held

\*Thesis accepted by American Laryngological, Rhinological and Otological Society.

near the meatus, if the stem be then inserted into the auditory canal the fork is again heard via air, and usually for a period of about 12 seconds. This method I have used in a number of cases and reported in a paper, "A Suggestion Regarding the Rinne Test" (read before the Chicago Laryngological and Otological Society, Nov. 16, 1915), in which I found an average of 13 seconds. This modification of the test shows that the stem vibrates as long as the prongs, and also calls attention to the decided superiority of the air conduction over the bone conduction.

While Rinne described the test under discussion, it was Lucae who really brought about its practical application in otology. He claimed, however, that it is only of diagnostic aid when the hearing for the whispered voice has been reduced to one meter. Politzer stated that the diagnostic importance of the Rinne test was proven by post-mortem findings in some of his, Bezold's and other cases.

There is no intention or expectation in analyzing the figures we have obtained of making any discoveries or perhaps even calling attention to anything very startling, but the idea which prompted the entire work was to make most careful tests in order to see whether the results obtained coincided with those of other otologists, and to see if it was possible to determine which fork, if any, was best adapted for use in the average run of cases.

By personal communication we learned which forks were employed by some of the best known European authorities in the carrying out of the Rinne test. Heiman (Warsaw) uses C (64 v.d.), c (128 v.d.) and c<sup>2</sup> (512 v.d.); Schmiegelow (Copenhagen) employs a<sup>1</sup> (435 v.d.); Urbantschitsch (Vienna) uses C (64 v.d.), c<sup>1</sup> (256 v.d.) and c<sup>2</sup> (1024 v.d.); Hartmann (Berlin) employs c (128 v.d.); Alexander (Vienna), Neumann (Vienna) and Politzer (Vienna) use the weighted c<sup>1</sup> (154 v.d.) fork; Moeller (Copenhagen), Denker (Erlangen) and Siebenmann (Basel) all use the a<sup>1</sup> (435 v.d.) fork; Uchermann (Christiansia) and Passow (Berlin) use the c<sup>1</sup> (256 v.d.); Bruehl (Berlin) employs C (64 v.d.), c (128 v.d.), c<sup>1</sup> (256 v.d.) and c<sup>2</sup> (512 v.d.); Kümmel (Heidelberg) uses the e (186 v.d.) unweighted, and Lucae (Berlin) the weighted c (128 v.d.) fork. Bezold's (Munich) use of the a<sup>1</sup> fork has been emphasized.

There are at least seven or eight varieties of Rinne reactions:

I. Two forms of the positive Rinne:

(a) Positive, in which the air conduction is much longer than the bone conduction, but both are normal in duration; this is the normal, positive Rinne.

(b) Positive, air conduction longer than bone conduction, but both of them shortened as compared with the normal duration; this form is found in internal ear trouble, with impairment of hearing.

II. Three forms of the negative Rinne:

(a) Bone conduction much increased and longer than the air conduction, which latter is moderately diminished; this form is found in the ordinary middle ear disease.

(b) Bone conduction longer than air, but both diminished as compared with the normal; here we often find a combination of internal and middle ear disease.

(c) Bone conduction greater than air, but both very much shortened; this form occurs in very far advanced ear disease, because air conduction is then lost more rapidly than the bone.

III. "Indifferent" ( $\pm$ ) Rinne. Of this there are two varieties:

(a) Air and bone conduction of equal length, because air conduction is slightly diminished and bone conduction slightly increased; hearing is good in this form, in which a slight middle ear affection is usually the condition present.

(b) Air and bone conduction equal in duration, but both of them much shorter than the normal; in this form the hearing is very poor, as this reaction is usually found in cases of serious internal ear disease.

IV. "Infinite" ( $\$$ ) Rinne. If not heard at all by air, but somewhat by bone, we have so-called infinitely negative Rinne; this is often found in cases of far advanced internal ear disease. While it seems almost impossible to have a positively infinite Rinne; that is, heard somewhat by air, but not at all by bone, still we have found it in two of our cases, namely, Nos. 7 and 31.

Politzer thus summarizes the uses of the Rinne: "(a) The test is very important in cases of marked impairment of hearing with involvement of the conduction apparatus where other objective diagnostic signs are lacking. In the majority of such cases the Rinne is negative, provided no complication, such as a nerve degeneration, is present. (b) The negative Rinne more definitely indicates conduction impairment, the greater the difference between the time during which the fork is heard via air, and the duration of its appreciation by bone conduction. The diagnosis is further supported by the loss of hearing for low tones, the relatively better hearing of the high tones, and the prolongation of bone conduction (Schwabach test). (c) In middle ear disease with only moderate diminution in hearing, the Rinne is of only slight diagnostic import, since most

of these cases are positive, despite some prolongation of bone conduction. This is not seldom seen in cases of suppurative otitis media with perforation of the drum membrane. Bruehl found when using the lower forks that the Rinne is sometimes negative even when no marked disturbance of hearing was present. (d) In unilateral middle ear disease with markedly impaired hearing the diagnostic value of the Weber is greater than the Rinne. (e) In elderly individuals in whom, as a rule, bone conduction is shortened, the Rinne often gives no accurate information. (f) Likewise, in cases of advanced auditory nerve affection complicated with chronic middle ear disease, the Rinne often gives indefinite results. (g) Even where the Rinne is positive in cases of severe impairment of hearing, a diagnosis of disease of the auditory nerve can only then be made if supported by corroborative history, course of the disease and symptoms, together with such findings as loss of hearing for the upper tones, relatively good hearing for the lower tones and diminished bone conduction." The same author maintains that even though in exceptional cases this test may be positive in middle ear involvement, accompanied by poor hearing, and negative in severe labyrinthine disease, these facts do not materially lessen the value of the Rinne when it is used in combination with other diagnostic tests.

Urbantschitsch is inclined to believe, with some other authors, notably Burckhardt-Merian, Schwabach and Eitelberg, that the Rinne test is rather unreliable. He claims that he has found instances in which the same ear condition gave varying results; that in the same case the findings differed, depending on the place at which the fork was held against the bone; that applied to the same region of the head various forks gave contradictory results, and lastly, that repeated on different days the findings in the Rinne test may decidedly disagree with one another.

Bönninghaus contends that while a diagnosis cannot depend entirely on the Rinne test, it is of great aid when combined with other measures. He cites Zimmerman and Quix, who deny all value to the Rinne because it measures the difference between two factors, namely, the vibration of the fork stem and its prongs, which are physically so different that they are not comparable. Bönninghaus admits this, but says that since we make the same error in each test, the results can be compared with one another and that suffices for the practitioner, even if it does not for the physiologist. While the prongs move in transverse vibrations of large amplitude and slight intensity,

the stem at the same time and for just as long a period, shows longitudinal vibrations of small amplitude, but great intensity.

Bezold is one of the ablest advocates of the utility of the Rinne test and has contributed many papers dealing therewith. In one of these (*Funktionelle Prüfung des Ohres*, Vol. 1, p. 46) he states that he agrees with Lucae's view that only in cases where hearing for whisper is reduced to one meter can the test be of great aid. He believes that it is a mass vibration and not molecular vibration which transmits the sound waves to the auditory nerve. Even where the sound is conducted through the bone, he considers it as an osteo-tympanic route and due to mass vibration, at least up to the labyrinth. Bezold rejects the explanations for the lateralization of the Weber test (if we may so far digress as to mention this), and of the negative Rinne.

Mach's theory is that the bone conduction is increased by any disturbance in the external or middle ear because the normal outward flow of sound is thereby hindered and a second reflection of the sound towards the labyrinth ensues. This presupposes, first, a direct molecular transmission from bone to inner ear, and secondly, that *normally* the conduction apparatus transmits sound vibrations as easily outwards as inwards. The first assumption is unproven, and according to Helmholtz the second theory is untenable because the lever action of the conducting chain, whose long arm consists of the radiating fibers of the drum membrane, easily transmits inwards the slightest changes in air vibrations, but cannot, by means of the short lever arm, namely, the fibers of the ligamentum annulare, transmit them outwards.

Weber, Brunner and Lucae believe that the increase of bone conduction in middle or external ear obstruction is partly due to the resonance of the imprisoned column of air. The presence of fluid on either side of the drum membrane increases the bone conduction because the fluid is a better medium for transmission of sound from the bone to the membrana tympani than is the air. The theory of resonance produced by the air in the middle ear spaces does not, however, explain the occurrence (so very often noted) of increased bone conduction (negative Rinne), when the middle ear is filled with secretion. Bezold's theory is based on certain physiological findings and experiments. For the proper sound transmission via air the conduction apparatus must be in a state of equilibrium, a slight disturbance of which, such as a pure tubal occlusion, is sufficient to produce a decided diminution in air conduction, and an equally definite increase in bone conduction. This equilibrium is

likewise affected by large perforations through the drum membrane with a loss of some of the radiating fibers, and a resulting overaction of the tensor tympani muscle. Various sclerotic processes in the tympanic cavity may also cause an increased tension of the conducting apparatus. Bezold holds that *bone conduction* is brought about by means of the sound conducting apparatus of the middle ear and *differs* from air conduction *only* in the fact that with bone conduction the sound waves strike the *edge* of the drum membrane and the ligamentum annulare, and not the flat surfaces thereof. By experiment he showed that increased tension in the conducting apparatus and at the same time that of the ligamentum annulare produced lengthened bone conduction, but a diminution for air conduction. On this basis he claims to have a simple explanation for the findings in the Weber and Rinne reactions in the majority of cases of middle ear affections. The increased tension ("anspannung") at any point in the conducting apparatus reduces its ability to transmit air-bone sound waves, but heightens its ability to conduct vibrations via bone to the labyrinthine fluid. Thus are produced those decided differences between middle ear and internal ear diseases, which are particularly demonstrated by the Rinne test (*Funktionelle Prüfung*, Vol. 1, p. 50). In his series of Rinne tests, Bezold uses both the a<sup>1</sup> and A forks, but with the latter fork the bone conduction was measured from the vertex and not from the mastoid process, because the sound could be localized less in one ear and, secondly, the mere weight of the larger fork (A) sufficed to hold it in position without undue or uneven pressure of the hand. In his long series of cases, Bezold was struck by the great influence of heredity in disease of the conduction apparatus as compared with affection of the auditory nerves. He holds that the findings in his cases confirm his theory that increased tension in the conduction apparatus accounts, in the majority of cases, for the increased bone conduction and the consequent negative Rinne. The frequent occurrence of a positive Rinne in cases of acute and sub-acute otitis media with markedly impaired hearing, Bezold is unable to explain, especially in view of the fact that in these very cases the Weber is usually lateralized to the diseased side and the Schwabach is prolonged. We have also found this in certain of our cases, namely, Nos. 5, 8 and 74.

Bezold's conclusions are:

1. In all bilateral diseases of ears where the difference in hearing between the two sides is not too great a negative, Rinne shows the presence of a change in the conduction apparatus. But the

converse does not always obtain, for a shortened or even *positive* Rinne may often be had (a) in chronic conditions where the findings with otoscope or catheter are negative, and the hearing for whisper is above 1 meter, and (b) in acute or subacute otitis media with exudate in the tympanum and a marked diminution in hearing (v.s.).

2. In a severe *unilateral* affection the Rinne may be negative, even though the conduction apparatus is intact.

3. When the *positive* Rinne is of normal duration or only slightly shortened, and the hearing greatly impaired, but the speculum and catheter findings are normal, then any material involvement of the conduction apparatus may be excluded, regardless of the unilateral or bilateral character of the condition present.

Bezold further says that with an A (108 v.d.) fork the findings, at least in cases of middle ear disease, are more definite than with the a<sup>1</sup> (435 v.d.), since the duration of the negative Rinne is always longer. This explains the fact that in a *shortened positive* with an a<sup>1</sup> fork, the test with an A fork may show a *short negative*, but the contrary is never true, namely, a positive Rinne with A when it is negative with the a<sup>1</sup> fork.

Retjo, in a recent article which embodies the essentials of his paper, "Zur Physiologic der Knochenleitung" (read before the Congress der Deutschen Otologischen Gesellschaft in Kiel, 1914), emphasizes the importance he attaches to the function of the round window in sound conduction. He calls attention to the fact that while R. Panse many years ago wrote on this subject, it has been a rather neglected one.

Very careful investigations will be needed to determine the role played by the membrana tympani secondaria. Troeltsch demonstrated that since fluids are practically incompressible, the stapedial foot plate can only be pressed into the oval window if simultaneously the elastic membrane of the round window is pushed outwards.

The cases from which the data we mention in this paper were obtained were examined while the writer was serving in the clinic of the late Prof. Gerber in Koenigsberg, Prussia, in 1909. One hundred unselected cases were carefully examined, not only with regard to the clinical findings in the ears, but with complete functional tests. The principal tuning-fork tests employed were the Weber, Rinne and Schwabach. Some years ago the figures with reference to the Weber test were carefully analyzed in a thesis read before the Chicago Laryngological Society in 1911, entitled "An Analysis of the Weber Test in One Hundred Cases." At that time state-

ments were made to the effect that it was our opinion that while it is no doubt true that so far as practical results are concerned, it probably makes no great difference whether a fork is weighted or not, or whether we are informed exactly regarding the nature of the fork when the Weber test is made; in the Rinne test it often does make a considerable difference, as will perhaps be shown in a later paper. But even granting for argument's sake that the different forks do not vary sufficiently to affect the practical results of the test, surely the first requirement of scientific work would demand that accurate statement be at all times made by investigators regarding the instruments they employ. Furthermore, merely mentioning the fact that a fork is weighted or not will exactly designate the one used, will thus convey a clear idea to the reader, and certainly calls for no great effort on the part of the writer." The forks used in these examinations were the unweighted, a<sup>1</sup> (435 v.d.), the weighted c<sup>1</sup> (154 v.d.), and the unweighted A (108 v.d.) forks of Edelmann. These forks were chosen because the small a<sup>1</sup> and A are those employed and recommended by that master of functional testing, Bezold, and the weighted c<sup>1</sup> (either an Edelmann or a Reiner fork), because it is the one used in the Vienna clinic to a great extent. In order to have uniformity in the duration of vibration the forks were always made to functionate by holding them at right angles to the body, and allowing a small rubber pleximeter to fall from a perpendicular position directly upon one of the prongs, the hammer being permitted to drop from a perpendicular to a horizontal position, striking the prong. The large A fork was excited by allowing it to fall from a perpendicular position to a horizontal one, striking the knee. The forks were held as loosely as possible by the stem and permitted to rest on the head without any pressure other than that due to the weight of the fork, particularly when using the A fork. Where any uncertainty seemed to exist in the mind of the patient, the tests were repeated many times, care being taken to avoid all suggestions. The difference between hearing a fork and feeling its vibrations was explained to each individual and demonstration made by placing the vibrating forks on the patella, fingers and elsewhere.

While my fingers (as shown in the tables and summaries) for the time during which the forks are heard by patients may be longer than those given by many writers, let me say, that in order to get accurate results the tests were performed in a quiet room and many times repeated in order to check the findings, often more than one or two hours being spent with a single case.

## BOTH EARS POSITIVE.

Age, History, Etc.	Right Ear			Left Ear	
	Duration in seconds	Ratio air to bone, per cent		Duration in seconds	Ratio air to bone, per cent
Case 9, male, 55 yrs. Tinnitus and poor hearing. Affectio nervi acustici.	A 80* c <sup>1</sup> 57* a <sup>1</sup> 25*	500 416 266		A 70* c <sup>1</sup> 49* a <sup>1</sup> 21*	800 406 250
Case 10, female, 42 yrs. Chronic adhesive process. No suppuration. Some Affectio nervi. Acustici. Poor hearing.	A 95* c <sup>1</sup> 85* a <sup>1</sup> 40*	416 312 500		105* 85* 36*	480 312 500
Case 12, female, 17 yrs. Rhinitis atrophica. Drums normal. No ear symptoms.	A 40* c <sup>1</sup> 90* a <sup>1</sup> 35*	150 228 200		30* 80* 35*	130 188 177
Case 13, female, 21 yrs. Otitis media acuta (dex.) 6 months ago. Now healed. Tinnitus right.	A 50* c <sup>1</sup> 60* a <sup>1</sup> 35*	183 220 216		50* 50* 35*	162 171 200
Case 14, female, 19 yrs. Epistaxis. No ear symptoms.	A 95* c <sup>1</sup> 65* a <sup>1</sup> 35*	258 208 177		80* 70* 35*	200 216 177
Case 17, female, 16 yrs. No ear symptoms. Normal.	A 55* c <sup>1</sup> 70* a <sup>1</sup> 62*	178 177 288		60* 70* 55*	166 170 257
Case 18, female, 20 yrs. Rhinitis atrophica. Laryngitis (chronic). Some tinnitus; impaired hearing.	A 25* c <sup>1</sup> 55* a <sup>1</sup> 30*	171 320 200		15* 40* 15*	120 166 133
Case 20, male, 15 yrs. Deviated septum. No ear symptoms. Normal ears.	A 60* c <sup>1</sup> 60* a <sup>1</sup> 38*	166 200 218		60* 60* 35*	166 200 200
Case 23, male, 19 yrs. Laryngitis (tubercular). Slight feeling of fullness in ears.	A 95* c <sup>1</sup> 60* a <sup>1</sup> 55*	246 209 257		90* 60* 40*	228 192 200
Case 25, male, 22 yrs. Ears normal. No symptoms.	A 90* c <sup>1</sup> 60* a <sup>1</sup> 47	228 209 223		90* 60* 50*	228 209 243
Case 26, female, 24 yrs. Nasal polyps. No ear symptoms.	A 45* c <sup>1</sup> 50* a <sup>1</sup> 45*	190 176 212		40* 50* 40*	180 171 214
Case 27, male, 50 yrs. Deviated septum. Some impairment of the hearing. Affectio nervi acustici.	A 95* c <sup>1</sup> 60* a <sup>1</sup> 35*	311 220 333		100* 70* 65*	266 227 533
Case 28, male, 15 yrs. Atrophic drum membrane. Tinnitus, right, for two weeks. Some affectio nervi acustici.	A 80* c <sup>1</sup> 60* a <sup>1</sup> 45*	300 209 228		80* 60* 45*	300 209 228
Case 29, male, 29 yrs. Some tinnitus, left. Impaired hearing after suppuration. Slight affectio nervi.	A 30* c <sup>1</sup> 40* a <sup>1</sup> 35*	143 166 177		30* 35* 45*	150 158 228
Case 30, female, 36 yrs. Affectio nervi acustici. Marked tubal-catarrh, left.	A 70* c <sup>1</sup> 35* a <sup>1</sup> 30*	200 144 166		25* 25* 25*	138 135 183

## BOTH EARS POSITIVE.

Age, History, Etc.	Right Ear			Left Ear	
	Duration in seconds	Ratio air to bone, per cent		Duration in seconds	Ratio air to bone, per cent
Case 31, male, 79 yrs. Tinnitus and impaired hearing. Affectio nervi.	A 90*	§		80*	§
	c <sup>1</sup> 70*	275		60*	250
	a <sup>1</sup> 45*	280		30*	220
Case 32, male, 32 yrs. Ethmoiditis. No ear symptoms.	A 110*	257		110*	257
	c <sup>1</sup> 65*	193		55*	169
	a <sup>1</sup> 55*	200		55*	200
Case 34, male, 32 yrs. Tubal catarrh 5 years ago. No ear symptoms now. Slight affectio nervi.	A 115*	483		100*	433
	c <sup>1</sup> 95*	416		75*	266
	a <sup>1</sup> 50*	350		28*	187
Case 35, male, 23 yrs. Chronic laryngitis. Normal ears.	A 75*	207		60*	166
	c <sup>1</sup> 45*	175		38*	153
	a <sup>1</sup> 45*	200		50*	211
Case 36, female, 64 yrs. Tinnitus. Tubal catarrh.	A 20*	125		10*	112
	c <sup>1</sup> 30*	150		40*	157
	a <sup>1</sup> 40*	200		40*	200
Case 38, male, 21 yrs. Tinnitus. Some affectio nervi.	A 60*	250		45*	169
	c <sup>1</sup> 55*	223		55*	200
	a <sup>1</sup> 35*	240		28*	170
Case 41, female, 22 yrs. Chronic ethmoiditis. No ear symptoms. Slight retraction.	A 20*	122		10*	112
	c <sup>1</sup> 5*	107		5*	107
	a <sup>1</sup> 35*	200		35*	200
Case 42, female, 30 yrs. No ear symptoms. Normal drums.	A 60*	154		65*	154
	c <sup>1</sup> 50*	183		50*	171
	a <sup>1</sup> 40*	188		47*	156
Case 43, female, 21 yrs. Recently tinnitus and impaired hearing. Some atrophy of drum membranes.	A 80*	215		110*	257
	c <sup>1</sup> 55*	191		65*	207
	a <sup>1</sup> 50*	243		50*	243
Case 53, female, 15 yrs. Adenoids. No ear symptoms.	A 35*	154		35*	154
	c <sup>1</sup> 30*	150		40*	166
	a <sup>1</sup> 55*	210		55*	210
Case 54, male, 27 yrs. No ear symptoms. Drums slightly cloudy.	A 60*	175		75*	192
	c <sup>1</sup> 35*	146		40*	153
	a <sup>1</sup> 25*	141		30*	150
Case 56, male, 15 yrs. No ear symptoms. Nasal polyps.	A 90*	212		80*	188
	c <sup>1</sup> 50*	162		50*	162
	a <sup>1</sup> 35*	163		30*	154
Case 57, female, 14 yrs. Chronic rhinitis. No ear symptoms.	A 50*	155		60*	163
	c <sup>1</sup> 45*	175		45*	164
	a <sup>1</sup> 35*	177		40*	173
Case 59, male, 30 yrs. No ear symptoms. Some retraction of drums.	A 95*	212		110*	229
	c <sup>1</sup> 80*	200		80*	200
	a <sup>1</sup> 55*	222		55*	222
Case 60, male, 20 yrs. No ear symptoms. Normal drums.	A 55*	173		55*	173
	c <sup>1</sup> 40*	166		30*	142
	a <sup>1</sup> 40*	188		40*	188
Case 62, female, 26 yrs. No ear symptoms. Drum membranes normal.	A 65*	168		80*	180
	c <sup>1</sup> 30*	143		60*	185
	a <sup>1</sup> 60*	271		60*	250

## BOTH EARS POSITIVE.

Age, History, Etc.	Right Ear			Left Ear	
	Duration in seconds	Ratio air to bone, per cent		Duration in seconds	Ratio air to bone, per cent
Case 64, male, 28 yrs. Affectio nervi acustici (bilateral). Tinnitus, left ear.	A 65*	218		45*	181
c <sup>1</sup> 80*	260		50*	200	
a <sup>1</sup> 60*	300		50*	266	
A 120*	250		110*	222	
Case 69, male, 23 yrs. No ear symptoms.	c <sup>1</sup> 100*	243		90*	212
a <sup>1</sup> 65*	244		55*	200	
Case 70, male, 27 yrs. Acute laryngitis. Tinnitus, left for 2 weeks. Some affectio nervi acustici.	A 75*	193		55*	169
c <sup>1</sup> 55*	210		55*	210	
a <sup>1</sup> 50*	225		35*	200	
Case 72, male, 30 yrs. No ear symptoms.	A 105*	216		90*	200
c <sup>1</sup> 75*	194		70*	193	
a <sup>1</sup> 55*	191		50*	183	
Case 73, female, 40 yrs. Nasal polyps. Cloudy drum membranes. Occasional tinnitus.	A 70*	177		65*	172
c <sup>1</sup> 85*	241		60*	200	
a <sup>1</sup> 45*	212		40*	200	
Case 76, male, 16 yrs. Chronic rhinitis and laryngitis. Cloudy right drum and feeling of fullness.	A 50*	155		75*	183
c <sup>1</sup> 30*	150		40*	166	
a <sup>1</sup> 35*	170		40*	180	
Case 80, male, 12 yrs. Rhinoscleroma. Some retraction of drums. Slight affectio nervi acustici.	A 75*	183		85*	206
c <sup>1</sup> 35*	153		35*	153	
a <sup>1</sup> 45*	212		45*	212	
Case 83, female, 20 yrs. Rhinitis hypertrophic. Ears normal.	A 85*	194		88*	195
c <sup>1</sup> 70*	187		75*	188	
a <sup>1</sup> 30*	160		40*	180	
Case 85, female, 46 yrs. Tumor laryngis. Affectio nervi acustici.	A 70*	187		70*	187
c <sup>1</sup> 50*	200		50*	200	
a <sup>1</sup> 40*	214		35*	200	
Case 91, male, 40 yrs. Rhinitis atrophica. Some cloudiness drum membranes. No ear symptoms.	A 90*	212		70*	187
c <sup>1</sup> 65*	230		50*	200	
a <sup>1</sup> 45*	228		25*	171	
Case 95, female, 32 yrs. Drum membranes normal. Increasing impairment of hearing. Slight affectio nervi acustici.	A 80*	260		75*	236
c <sup>1</sup> 60*	250		55*	222	
a <sup>1</sup> 35*	240		30*	200	
Case 97, female, 22 yrs. Rhinitis hypertrophic. Ears normal.	A 85*	189		85*	189
c <sup>1</sup> 70*	208		70*	208	
a <sup>1</sup> 48*	220		48*	220	
Case 99, male, 51 yrs. Drum membranes normal. Retro-auricular abscess left opened 4 years ago. Pain in left ear last few weeks.	A 45*	147		45*	145
c <sup>1</sup> 50*	171		45*	160	
a <sup>1</sup> 43*	223		45*	228	
Case 100, male, 73 yrs. Both drum membranes retracted. Thumping in ears and poor hearing for past few weeks. Some affectio nervi acustici.	A 65*	218		65*	208
c <sup>1</sup> 60*	200		65*	218	
a <sup>1</sup> 35*	240		40*	260	

## ONE EAR POSITIVE—ONE EAR NEGATIVE.

Age, History, Etc.	Right Ear			Left Ear		
	Duration in seconds	Ratio air to bone, per cent		Duration in seconds	Ratio air to bone, per cent	
	Right ear positive			Left ear negative		
Case 2, male, 17 yrs. Otitis media (suppurative) Chronic sinusitis. Total de- struction of drum.	A 34*	137		A 38†	161	
Otitis media (suppurative)	c <sup>1</sup> 60*	185		c <sup>1</sup> 27†	156	
Chronic sinusitis. Total de- struction of drum.	a <sup>1</sup> 17*	129		n <sup>1</sup> 15†	133	
Case 3, female, 13 yrs. Otitis media (suppurative) Chronic sinusitis. Total de- struction of drum. Some vertigo.	A 20*	118		A 45†	280	
Otitis media (suppurative)	c <sup>1</sup> 35*	150		c <sup>1</sup> 40†	300	
Chronic sinusitis. Total de- struction of drum. Some vertigo.	a <sup>1</sup> 30*	220		a <sup>1</sup> 15†	200	
(N. B.—Cases No. 2 and No. 3 show how independently ears react to R. test, one side as compared with the other.)						
	Right ear negative			Left ear positive		
Case 5, male, 11 yrs. Ca- tarrah tubanus (dex.).	A 40†	166		10*	111	
	c <sup>1</sup> 20†	131		10*	112	
	a <sup>1</sup> 15†	133		10*	120	
Case 7, female, 20 yrs. Radical mastoid (dex.).	A 40†	§		12*	§?	
Cloudy drum (sin.). High tinnitus.	c <sup>1</sup> 25†	§		18*	§?	
	a <sup>1</sup> 15†	400		18*	§?	
(N. B.—In this case closure of left ear with finger caused fork to be heard in that ear when placed on vertex or mastoid.)						
Case 8, male, 51 yrs. Otitis media, suppurativa chronic dex. Otitis media, suppurativa acuta sin. Tin- nitus right.	A 30†	200	A ‡	0		
	c <sup>1</sup> 25†	183	c <sup>1</sup> ‡	0		
	a <sup>1</sup> 15†	166	a <sup>1</sup> 5*	125		
Case 16, female, 16 yrs. Otitis media (suppurativa) chronic dex. No tinnitus, etc.	A 40†	300	20*	128		
	c <sup>1</sup> 38†	272	30*	146		
	a <sup>1</sup> 15†	175	25*	162		
Case 19, male, 62 yrs. Otitis media, suppurativa acuta sin. Pain in ear.	A 25*	155	20†	200		
	c <sup>1</sup> 65*	244	35†	170		
	a <sup>1</sup> 35*	216	5†	120		
Case 21, male, 32 yrs. Chronic tubal catarrh, left. Pressure in ear, but no tinnitus.	A 75*	215	20†	166		
	c <sup>1</sup> 50*	162	10†	120		
	a <sup>1</sup> 45*	212	25‡	‡		
Case 24, female, 49 yrs. Otitis media, suppurativa acuta sin. Tinnitus bilat- eral.	A 65*	192	35†	187		
	c <sup>1</sup> 60*	200	15†	130		
	a <sup>1</sup> 35*	240	5†	120		
Case 32, female, 40 yrs. Healed otitis media, chron- ica bilateralis, also affectio nervi.	A 15†	§	25*	171		
	c <sup>1</sup> 10†	150	10*	116		
	a <sup>1</sup> 15*	200	25*	183		
Case 45, female, 15 yrs. Adenoids. Atrophic drums. Some impairment of hear- ing. Catarrh tubanus.	A 5†	105	10†	110		
	c <sup>1</sup> 80‡	§	80‡	‡		
	a <sup>1</sup> 5*	108	60‡	‡		
Case 46, male, 50 yrs. Right, complete destruction of drum, left retracted. Impaired hearing. Affectio nervi right. Catarrh tu- banus left.	A 45†	§	70*	300		
	c <sup>1</sup> 35†	§	45*	230		
	a <sup>1</sup> 10†	§	50*	600		

## ONE EAR POSITIVE—ONE EAR NEGATIVE.

Age, History, Etc.	Right Ear		Left Ear	
	Duration in seconds	Ratio air to bone, per cent	Duration in seconds	Ratio air to bone, per cent
Case 47, female, 14 yrs. Very unintelligent. Bilateral otitis media, chronic. Much destruction; poor hearing.	A 40*	157	5*	107
	c <sup>1</sup> 20*	133	10*	118
	a <sup>1</sup> 15†	150	15†	150
Case 48, male, 16 yrs. Acute mastoiditis, left, 4 years ago. Past 3 weeks again pus. Right ear normal.	A 30*	126	40†	150
	c <sup>1</sup> 35*	133	20†	129
	a <sup>1</sup> 50*	200	40‡	‡
Case 49, male, 28 yrs. Laryngitis, tubercular. No ear symptoms.	A 15†	123	40*	140
	c <sup>1</sup> 5†	109	25*	133
	a <sup>1</sup> 42‡	‡	40*	180
Cannot explain a <sup>1</sup> in this case.				
Case 51, female, 13 yrs. Otitis media, suppurativa acuta bilateral. Almost healed.	A 40†	200	80†	§
	c <sup>1</sup> 10†	116	50†	350
	a <sup>1</sup> 15*	130	30†	200
Cannot explain negative Rinne in right ear.				
Case 52, female, 49 yrs. Tinnitus and poor hearing. Retracted drum membranes. Affectio nervi acustici right.	A 30†	133	70†	216
	c <sup>1</sup> 90‡	‡	45†	175
	a <sup>1</sup> 30*	200	20†	166
Case 61, female, 8 yrs. Cholesteotoma, right, with impaired hearing. Left normal.	A 65†	533	15*	117
	c <sup>1</sup> 35†	240	30*	143
	a <sup>1</sup> 15†	175	55*	257
Case 63, male, 7 yrs. Otitis media, chronic suppurativa sin. Right normal. Child not very intelligent.	A 40*	157	30†	160
	c <sup>1</sup> 20*	122	30†	150
	a <sup>1</sup> 30*	150	65‡	‡
Case 65, female, 32 yrs. Otitis, externa dex. with mild otitis media. Pain right ear.	A 30†	146	70*	177
	c <sup>1</sup> 15†	118	35*	135
	a <sup>1</sup> 10*	125	45*	212
N. B. Positive with a <sup>1</sup> .				
Case 67, female, 47 yrs. Otitis media, suppurative acuta dex. Pain and impaired hearing.	A 60†	300	50*	155
	c <sup>1</sup> 40†	200	30*	137
	a <sup>1</sup> 18†	182	45*	200
Case 71, male, 22 yrs. Traumatic perforation, left. Impaired hearing; some tinnitus.	A 50*	150	70†	450
	c <sup>1</sup> 45*	164	20†	144
	a <sup>1</sup> 50*	225	20*	150
Case 74, female, 55 yrs. Healed otitis media, chronic sin. Occasional tinnitus. Subacute otitis media dex.	A 40*	150	30†	160
	c <sup>1</sup> 30*	143	30†	166
	a <sup>1</sup> 40*	200	25*	171
Positive with a <sup>1</sup> .				
Case 75, male, 45 yrs. Otitis media acuta sin. Pain left ear.	A 80*	188	40†	166
	c <sup>1</sup> 60*	186	30†	160
	a <sup>1</sup> 55*	257	12†	136
Case 77, female, 19 yrs. Radical mastoid, right, 2 years ago. Hearing very poor. Left ear normal.	A 70†	§	70*	177
	c <sup>1</sup> 50†	600	30*	143
	a <sup>1</sup> 29†	583	40*	188

## ONE EAR POSITIVE—ONE EAR NEGATIVE.

Age, History, Etc.	Right Ear		Left Ear	
	Duration in seconds	Ratio air to bone, per cent	Duration in seconds	Ratio air to bone, per cent
Case 78, female, 16 yrs. Otitis media subacute suppurativa dex. Left ear normal.	A 70† c <sup>1</sup> 30† a <sup>1</sup> 10†	450 160 125	60* 35* 35*	175 154 170
Case 81, male, 49 yrs. Healed otitis media, ac. dex. Otitis media, non-suppurativa acuta sin. Still some impairment, right.	A 70† c <sup>1</sup> 55† a <sup>1</sup> 20†	450 320 166	5† 80‡ 20*	106 § 140
Case 84, male, 13 yrs. Otitis media acuta sin. Right ear normal.	A 30* c <sup>1</sup> 20* a <sup>1</sup> 25*	130 122 141	45† 30† 30†	200 160 200
Case 86, male, 11 yrs. Acute tubal catarrh, right. Left normal.	A 30† c <sup>1</sup> 15† a <sup>1</sup> 55‡	133 116 ‡	35* 20* 25*	128 117 145
Case 87, female, 51 yrs. Otitis media, suppurative acuta dex., 2½ yrs. ago. Otitis media, sup. subacute, sin.	A 30* c <sup>1</sup> 35* a <sup>1</sup> 33*	133 150 163	75† 45† 15†	§ 400 150
Case 88, female, 14 yrs. Large adenoids. Tinnitus left. Left drum retracted.	A 70* c <sup>1</sup> 52* a <sup>1</sup> 37*	187 176 170	20† 13† 50‡	140 123 §
Case 89, female, 26 yrs. Dry perforation, right, following otitis media sup. in childhood. Tinnitus right. Left drum cloudy, retracted.	A 85† c <sup>1</sup> 30† a <sup>1</sup> 5†	525 166 112	45* 50* 30*	147 171 185
Case 90, female, 46 yrs. Right drum retracted. Total destruction left drum. Tinnitus, poor hearing left.	A 40* c <sup>1</sup> 30* a <sup>1</sup> 35*	140 140 177	60† 45† 23†	300 280 253
Case 92, female, 54 yrs. Unhealed radical mastoid, left. Pains left side. Right normal, except cloudiness.	A 75* c <sup>1</sup> 70* a <sup>1</sup> 62*	216 275 410	55† 30† 10†	§ § §
Case 96, female, 24 yrs. Right normal. Otitis media, sup. chronic sin.	A 50* c <sup>1</sup> 50* a <sup>1</sup> 42*	155 183 211	50† 10† 10†	266 125 140

## BOTH EARS NEGATIVE.

Case 1, male, 11 yrs. Otitis media, chronic suppuration after scarlatina.	A 30† c <sup>1</sup> 15† a <sup>1</sup> 10†	137 121 120	A 30† c <sup>1</sup> 20† a <sup>1</sup> 24†	140 125 129
Case 4, female, 16 yrs. Otitis media, chronic sin. bilateral, fetid pus. Attic fistula left.	A 40† c <sup>1</sup> 35† a <sup>1</sup> 39†	180 177 305	80† 70† 37†	§? §? 511
Case 6, female, 34 yrs. Right drum normal. Left shows catarrh. Atypical otosclerosis. Nerve involvement. Tinnitus.	A 47† c <sup>1</sup> 30† a <sup>1</sup> 11†	687 700 275	30† 15† 10†	160 137 166

## BOTH EARS NEGATIVE.

Age, History, Etc.	Right Ear			Left Ear		
	Duration in seconds	Ratio air to bone, per cent		Duration in seconds	Ratio air to bone, per cent	
Case 11, female, 32 yrs. Affectio nervi acustici. Right drum cloudy. Left drum normal. Poor hear- ing and tinnitus.	A 44† c <sup>1</sup> 55† a <sup>1</sup> 12†	§ § §		50† 30† 12†	185 214	
Case 15, male, 11 yrs. Subacute secretory ca- tarrh, bilateral. Tinnitus.	A 40† c <sup>1</sup> 35† a <sup>1</sup> 5†	260 200 109		30† 25† 7†	166 145 112	
Case 22, male, 45 yrs. Retracted drum mem- branes. Tinnitus and some impairment of hearing.	A 60† c <sup>1</sup> 10† a <sup>1</sup> 17†	250 115 194		65† 10† 20†	425 120 233	
Case 37, male, 15 yrs. Right intermittent, otitis media, chronic. Left un- healed radical mastoid.	A 80† c <sup>1</sup> 40† a <sup>1</sup> 5†	300 166 110		100† 75† 30†	§ 400 250	
Case 39, male, 17 yrs. Otitis media, chronica in childhood. Right drum re- tracted. Tinnitus. Rhinitis hypertrophic and adenoids. Affectio nervi.	A 80† c <sup>1</sup> 25† a <sup>1</sup> 55†	300 138 ‡		120† 70† 40†	§ 450 366	
Case 40, female, 17 yrs. Otitis media, sin. acuta bi- lateralis. Earache and im- paired hearing.	A 55† c <sup>1</sup> 45† a <sup>1</sup> 15†	650 250 175		55† 25† 45†	375 150 ‡	
Case 44, female, 35 yrs. Otitis media, chronic bi- lateral in childhood. Now dry. Large perforation. Im- paired hearing.	A 80† c <sup>1</sup> 50† a <sup>1</sup> 20†	500 200 166		75† 40† 15†	600 180 180	
Case 50, female, 9 yrs. Otitis media, chronica bi- lateral. Much destruction.	A 40† c <sup>1</sup> 40† a <sup>1</sup> 35†	§ 300 333		40† 50† 40†	§ 600 500	
Case 55, female, 18 yrs. Otitis media, suppurative chronic bilateral. Tinnitus and impaired hearing.	A 50† c <sup>1</sup> 40† a <sup>1</sup> 35†	§ 366 333		60† 45† 37†	§ 325 306	
Case 58, male, 18 yrs. Otitis media suppurative chronic bilateral. Attic fistula left. Poor hearing.	A 55† c <sup>1</sup> 40† a <sup>1</sup> 23†	466 300 292		40† 20† 20†	233 150 200	
Case 66, male, 15 yrs. Otitis media suppurative chronic bilateral. Impaired hearing. Mastoid operation left side.	A 50† c <sup>1</sup> 40† a <sup>1</sup> 60‡	183 173 ‡		100† 60† 40†	§ 300 300	
Case 68, male, 14 yrs. Otitis media, suppurative acuta dex. Otitis media sup- purative chronica sinstra.	A 50† c <sup>1</sup> 40† a <sup>1</sup> 30†	225 200 266		25† 20† 25†	138 133 145	
Case 79, female, 16 yrs. Adenoids, rhinitis hyper. cloudy drum membranes. Hearing much impaired. Affectio nervi acustici.	A 65† c <sup>1</sup> 62† a <sup>1</sup> 25†	§ § 162		55† 50† 50†	§ § §	

Hard to explain by (§) negative Rinne.

## BOTH EARS NEGATIVE.

Age, History, Etc.	Right Ear			Left Ear		
		Duration in seconds	Ratio air to bone, Per cent		Duration in seconds	Ratio air to bone, Per cent
Case 82, female, 28 yrs. Otitis media, suppurative chronic bilateralis. Much destruction both ears.	A	90†	\$		100†	\$
	c <sup>1</sup>	70†	\$		55†	375
	a <sup>1</sup>	60†	\$		45†	400
Case 93, female, 20 yrs. Large polyps right. Total destruction left. Suppura- tion and impaired hearing.	A	65†	360		60†	233
	c <sup>1</sup>	50†	266		30†	150
	a <sup>1</sup>	20†	200		10†	133
Case 94, female, 32 yrs. Drum membranes cloudy and right retracted. Im- paired hearing with tin- nitus in left ear. (Very thick hair.)	A	50†	211		105†	1150
	c <sup>1</sup>	40†	200		75†	475
	a <sup>1</sup>	13†	159		32†	277
Otosclerosis?						
Case 98, female, 21 yrs. Radical mastoid operations both sides. Hearing very poor.	A	50†	\$		75†	\$
	c <sup>1</sup>	32†	\$		35†	333
	a <sup>1</sup>	25†	\$		24†	233
TOTAL						
59660		56511				
60260		57311				
200.08 per cent		191 per cent				
215.9						
216 per cent		206 per cent				

Adding to this the per cent represented by \$ results, dividing by 300 = average. Dividing by 279 (right) and 278 (left), deducting cases of \$ reaction average.

In the above tables only the difference between the duration of hearing by air and bone is given in the first column for each ear, and the ratio between air and bone is stated in percentages in the second column.

Analysis of data derived from the 100 cases examined (that is, 200 ears):

The difference in time between air and bone conduction, and then the ratio of one to the other, or the percentage by which one preponderated over the other were determined in the 200 ears, each of which was examined with the three forks, namely, A (108 v.d.), weighted c<sup>1</sup> (154 v.d.) and a<sup>1</sup> (435 v.d.). The cases were divided into three groups: I. Those in which both ears were positive (45 cases); II. those in which one ear showed a positive and the other a negative Rinne (35 cases), and III. those in which both ears were negative (20 cases).

*Averages for the A fork:* (a) Differences in duration of hearing by bone and air conduction in the 45 cases in which both ears were positive averaged 68.9 seconds, and in 35 cases with one ear nega-

tive and the other positive, the average was 42.5 seconds; in the 20 cases with both ears negative the average was 60.3 seconds; for all the ears examined the grand average was 57.2 seconds.

(b) The percentage or the ratio between the bone and air conduction in (Group I.) was 212.8; in (Group II.), 194.9, and in (Group III.), 342., or a grand average of 250.2.

*Averages for the weighted c<sup>1</sup> fork:* (a) Difference in duration for hearing by bone and ear conduction, in Group I, 55.9 seconds; Group II, 34.9, and in Group III, 40.3, or a grand average of 43.7 seconds.

(b) The percentage or the ratio between the bone and air conduction in Group I was 200.8; Group II, 173.2, and in Group III, 253.0, or a grand average of 209.

*Average for the a<sup>1</sup> fork:* (a) Difference in duration for hearing by bone and ear conduction in Group I, 41.9 seconds; Group II, 26.9, and in Group III, 26.9, or a grand average of 31.9 seconds.

(b) The percentage or the ratio between the bone and air conduction in Group I was 221.8; Group II, 182.1, and in Group III, 229.2, or a grand average of 211.

The total average of difference in duration of hearing by bone and air conduction in the 200 ears and three different forks amounts to 44.2 seconds, and the total average of percentage or ratio of air to bone or vice versa is 223.4.

In other words, summing up these figures, we may say that, in this series of cases at least, with all the forks used, the ratio of air to bone in the positive, and of bone to air in the negative Rinne, is about 200 per cent, or two to one.

#### Relative value of the three forks employed:

I. The difference in the three forks employed as to the time that the various forks were heard is perhaps of no very great importance since the time average shown even by the a<sup>1</sup> fork is more than sufficient for all practical purposes.

II. Although there is no very great disparity in the ratios between air and bone conduction, as shown by the three forks, still the findings with the c<sup>1</sup> and a<sup>1</sup> forks coincide more nearly with one another than they do with those shown by the A fork.

The disadvantages the A (108 v.d.) fork lie in its great weight (although this is of advantage when doing the Weber and Schwabach tests), the difficulty in holding it steadily against the mastoid process, and the patient's frequent inability to distinguish well between

feeling and actually hearing it. The weighted c<sup>1</sup> (154 v.d.) and unweighted a<sup>1</sup> (435 v.d.) forks, on the other hand, can be easily applied and well appreciated by the patient, so that while there is from this standpoint perhaps not much to choose between them, still we believe that the a<sup>1</sup> fork is possibly the preferable one for several reasons:

1. Where the examiner is limited in his equipment to a few forks (a low, a medium and a high) for functional testing, the a<sup>1</sup> fork serves not only for the middle tone, but is very useful because its pitch lies directly in the so-called "speech area," and if heard by air shows that the individual has at least some perception for the voice.
2. It is very easily handled because of its compactness.
3. Its vibrations are such that when the fork is placed on one mastoid the sound will not be carried via air to the ear (provided the auricle is not touched), and when testing air conduction the sound is not transmitted to the other ear.
4. Lastly, this fork has given such reliable results in the hands of many authorities, for instance: Schmiegelow, Denker, Siebermann Stenger, Bezold, etc., that we may well avail ourselves of it.

#### ANALYSIS OF THE CASES EXAMINED.

##### I. Forty-five (45) cases both ears positive Rinne.

(2) *Affectio Nervi Acustici* (poor hearing, tinnitus, etc.)—16 cases (Numbers 9, 10, 13\*, 18\*, 27, 28, 29\*, 30\*, 31, 34||, 38, 64, 70\*, 80||, 85\*, 100\*).

(1) Ears with normal membrana tympani or at least no symptoms—25 cases (Numbers 12\*, 14\*, 17, 20, 23\*, 25, 26\*, 33\*, 34||, 36\*, 41\*, 42, 53\*, 56\*, 57\*, 59\*, 54, 60, 62, 69, 72, 83\*, 91\*, 97, 99\*).

(7) Nasal conditions: Rhinitis atrophica—3 cases (12\*, 18\*, 91\*). Epistaxis—1 case (14\*). Polyps—3 cases (26\*, 56\*, 73\*). Ethmoiditis—2 cases (33, 41). Chronic hypertrophic rhinitis—4 cases (57\*, 76||, 83\*, 97\*). Rhinoscleroma—1 case (80||).

(8) Laryngeal conditions: Tuberculosis—1 case (23\*). Chronic laryngitis—3 cases (18\*, 36\*, 76). Acute laryngitis—1 case (70\*). Tumor laryngis—1 case (85\*).

(4) Tubo-tympanic catarrh—8 cases (30\*, 34|| cured, 36\*, 43\*, 59\*, 76||, 100\* [with cloudiness, atrophy or retraction of drum membrane]).

(5) Acute Pain—1 case (99\*).

- (6) Adenoids—1 case (53\*).
- (3) Tinnitus and slightly impaired hearing, with no apparent or only *very slight affectio nervi acustici*—3 cases (43\*, 73\*, 95).

N. B.: In all the tables, case numbers which are not characterized showed only one noticeable or important finding, those characterized with (\*) showed two, and those characterized with (||) had three conditions present.

We see from these figures that in this group of forty-five cases in which both ears showed positive Rinne there were twenty-five with normal ears and 16 with *affectio acustici nervi*. This corresponds, of course, to the usual findings. Three of the cases had only very slight, if any, *affectio nervi acustici*.

II. Thirty-five (35) cases with negative Rinne in one ear and positive in other. *A* ears with negative reaction:

- (1) Otitis media suppurative chronica—12 cases (2\*, 3\*, 8\*, 16\*, 32\* healed, 46||, 47, 61\*, 63\*, 74\*, 90\*, 96\*).
- (3) Catarrh tubanus—4 cases (5\*, 21\*, 52\*, 86\*).
- (2) Otitis media suppurative acuta—10 cases (19\*, 24\*, 51\*, 65\*, 67\*, 75\*, 78\*, 81\*, 84\*, 87\*).
- (4) Dry perforation of drum membrane after otitis media in childhood—1 case (89\*).
- (5) Traumatic perforation of drum membrane—1 case (71\*).
- (6) No ear symptoms—1 case, 49\* (cannot explain this). Radical mastoid—3 cases, 7 (negative except for  $a^1$  fork), 77\*, 92\*. Acute mastoiditis—1 case (48\*). Adenoids—2 cases (45\*, 88\*). *Affectio nervi acustici*—1 case (46||). Vertigo—1 case (3||).

*B* ears with positive Rinne:

- (1) Normal reaction—21 cases (2\*, 3|| [ears like these show how independently of one another ears may react to Rinne test], 19\*, 21\*, 24\*, 48\*, 49\*, 61\*, 63\*, 65\*, 67\*, 71\*, 75\*, 77\*, 78\*, 84\*, 86\*, 88\*, 89\*, 92\*, 96\*).
- (3) Otitis media suppurative acuta—3 cases (8\* [reaction  $\pm A$  and  $c^1$  forks and + with  $a^1$  fork] 51\*, 74\*).
- (2) Some reduction in ratio between air and bone as compared with the normal—3 cases (5\*, 16\*, 90\*).
- (4) *Affectio nervi acustici* (one side), 2 cases (32\*, 52\*).
- (5) Otitis media suppurative acuta—1 case (81\*).
- (6) Healed otitis media suppurative acuta—1 case (87\*).
- (7) Catarrh tubanus—2 cases (45\*, 46||).

(8) Infinite reaction (§)—1 case, 7 (with all forks), cannot explain this reaction; closure of this ear caused fork to be heard in that ear when placed on vertex or mastoid.

III. Twenty (20) cases, negative Rinne in *both* ears.

(1) Otitis media suppurative chronica—13 cases. (a) Bilateral—12 cases (44, 50, both of these with large perforation and much destruction; 55, 58, attic fistula left side; 66, mastoid operation left side; 1, 4, attic fistula left; 37, 39, 82, 93, 98, bilateral radical mastoid). (b) Unilateral—1 case (68\*).

(2) Otitis media suppurative acuta—2 cases. (a) Bilateral—40. (b) Unilateral—68\*.

(3) Chronic catarrh tubanus—2 cases (15, 22).

(4) Affectio nervi acustici—3 cases (11, 39\*, 79\*).

(5) Otosclerosis (atypical)—2 cases, 6, 94 (with nerve involvement).

(6) Adenoids and rhinitis hypertrophic—1 case, 79\*. (This shows greatly impaired hearing and an "infinitely" (§) negative Rinne, which we cannot explain).

CONCLUSIONS.

I. The Rinne is probably the most valuable of the tuning fork reactions used in functional ear testing.

(2) The forks most often employed in the Rinne are c (128 v.d.), the unweighted c<sup>1</sup> (154 v.d.), the unweighted c<sup>1</sup> (256 v.d.) and the unweighted a<sup>1</sup> (435 v.d.).

(3) There are at least eight varieties of Rinne reaction. Two forms of positive: (a) Usually air conduction greatly exceeds bone conduction, giving the normal positive Rinne. (b) Positive Rinne with both air and bone conductions shortened in internal ear disease.

II. Three forms of negative Rinne: (a) Bone conduction much increased and air moderately diminished in ordinary middle ear disease. (b) Bone conduction longer than air, but both shorter than normal, often in combined middle and internal ear disease. (c) Both bone and air conduction greatly diminished; occurs in far advanced ear disease because air conduction then is lost faster than bone.

III. Two forms of "Indifferent" (‡) Rinne: (a) Air and bone conduction equal because air slightly diminished and bone conduction slightly increased. A slight middle ear affection is present and the hearing is quite good. (b) Air and bone conduction equal, but

both much shorter than normal. Serious internal ear disease is usually present and the hearing is very poor.

IV. Infinite Rinne (§). When not heard at all by air, but somewhat by bone, have "infinitely" negative (§) reaction. Found at times in far advanced inner ear diseases. Rarely an infinitely positive Rinne may appear (cases 7 and 31) which we cannot explain.

(4) The Rinne findings cannot alone make a diagnosis, but the test is of great aid when combined with other measures. Bezold and Lucae hold that only where hearing for whisper is reduced to one meter can this test be of great assistance.

(5) The general average in this series of cases of the difference in time between air and bone conduction in 200 ears was forty-four (44) seconds, which is longer than found by most examiners. The ratio of air to bone in the positive and of bone to air in the negative Rinne was about two to one (2 to 1).

(6) While no absolutely definite statement can be made, the unweighted a<sup>1</sup> fork (435 v.d.) seems best suited for performing the Rinne test.

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## VERTIGO AND ITS TREATMENT THROUGH ADRENALIN.

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The vertiginous sensation springs from an upset of the labyrinthine equilibrium, whether we consider the vestibular apparatus, the vestibular nerve or its connections with the centers. No need to recall to mind the fundamental experiments of Flourehs, Moll, Vulpius, Brown-Sequard, Lussana, Crum, Brown, Duval, etc., in order to show it. The caloric, rotary, galvanic tests (Barany, Babinski), which are daily practiced by otologists, are convincing from this point of view.

We know too well the *ab cure loca* vertigo, not to be able to recognize the vertiginous sensations through all its aspects, even when an obvious auricular cause yields, before a distant cause of sensitive or sensory kind. We know well enough neither the sympathetic reactions, which have a share in it, nor the endocrine disorders which often produce them.

*There is at the base of every vertiginous sensation a labyrinthine vasomotor or toxic phenomenon; and, therefore, a sympathetic or endocrine phenomenon, whose cause may be local, central or peripheral.*

It is for this reason that adrenalin, the hormone of the chromaffine system, appears to me able to favourably modifying vertigo, whenever the initial cause allows it.

The experience which I have acquired about it and which has gained those around me, has induced me to publish these first results.

The vertiginous sensation is in fact essentially a *phenomenon of labyrinthine irritation*, mobile, and fugacious as the cause which determines it; as the variations of a vasomotor kind in the sympathetic-tonic or vagotonic sphere, are themselves mobile and fugacious.

We are too forgetful of the fact that if the retina is often the mirror of a diathesis, the membranous labyrinth is like the retina, the reflect of peripheral or organic disorders.

So face to face with the vertiginous symptom, if the labyrinthine phenomenon cannot be misunderstood, an obvious local cause is not always necessary to explain it.

Deafness and tinnitus without vertigo are of frequent occurrence. Vertigo may be associated with them, although it may exist separately. It is not necessarily dependent on the same cause.

Mr. Lermoyez, in a lately published article in *La Presse Médicale*,<sup>1</sup> speaking of "vertigo that enables to hear," explains by means of an angiospasm the very interesting syndrome he describes.

With his patients, "the ear grows numb, drowsy, and it hums" \* \* \* "the auditory function seems to be irremediably abolished." Deafness and tinnitus exist alone until, one day, vertigo suddenly bursts out, and hearing appears again. It is as if "a storm had washed away a cloudy sky."

Therefore, vertigo does not always depend on the auricular claudication which causes deafness and tinnitus. With Mr. Lermoyez's syndrome, on the contrary, it corrects it. The vertiginous phenomenon has readily the labyrinth for center. The cochlear injury might possibly induce this localization, but the cause which originates vertigo is neither necessarily of the same kind nor is its signification the same.

Between Munière's female patient whom, on the occasion of an hemorrhagic labyrinthine overflow, because suddenly utterly deaf and suffered from tinnitus and vertigo, and Mr. Lermoyez's patients whom, through an angiospasm phenomenon suffered from deafness and tinnitus, which vertigo makes to disappear by "the raising of the vascular dam," there is evidently room enough for a whole series of vasomotor disorders from ischemia to congestion.

As Mr. Lermoyez points out, it may exist a spasm of the internal auditory artery or of one of its two branches, the vestibular artery or the cochlear artery. A vasomotor stasis in the sphere of this artery or of one of its branches, may inversely exist. This congestion<sup>2</sup> will produce the starting out of the vertiginous access, as well as the latter starts out through the sanguineous irruption, which destroys the labyrinthine anesthesia with Mr. Lermoyez's patients.

The spasm of the cochlear artery may bring about crises of deafness with tinnitus, without vertigo; and ischemia may be more or less severe.

The vasomotor stasis of the vestibular artery may bring about the vertiginous sensation, apart from all other manifestation, and vertigo takes them all the alternative forms of this type of congestion.

All this seems to confirm the facts that Mr. Lermoyez recalls to mind, as well as what I have just said above, *viz.*, that the verti-

ginous sensation is essentially a phenomenon of irritation. All of us otologists know that the *vertigo element disappears when the labyrinth has been destroyed, and that an irritation of the membrane duct of the semicircular canals or of the vestibular nerve is necessary to bring it about.*

The ischemia of a limb brings on its anesthesia. A violent irritation of the cutaneous tegument or of the mucous membranes, or an acute sensorial irritation determine a reflex vaso-dilatation on this point. The otologist knows well the reflex vaso-dilatation, which accompanies locally the slightest irritation of the tympanum or of the drum of the ear, as well as the vertigo that expresses it, chiefly if this action be violent.

A shrill sound irritating the extremities of the acoustic nerve may as well produce a reflex vaso-dilatation and vertigo.

I shall have thrown light upon this point when I have pointed out that, whatever the cause of vertigo (auricular, central or peripheral), this same phenomenon may be referred to and that the interpretation of the signs associated to vertigo, may be entirely drawn from what we know about the physio-pathology of the sympathetic nerve.

*There exist as many causes of vertigo as there are causes of labyrinthine vasomotor modifications, causes of toxic or endocrine modifications; local causes acting through contiguity or continuity or whether from a direct vaso-congestion, or from a change of pressure by which it is determined (labyrinthine inflammation, modification of the air pressure from the duct, etc. \* \* \*), general causes, (organic, neuro-glandular, central), acting equally through the medium of the sympathetic or parasympathetic system (cranial sympathetic).*

So, whether it be vertigo *ab aure locsa*, vertigo coming from an abnormal sensitive excitation in the sphere of the sensitive or sensory cranial nerves, vertigo born of whatever irritation of the splanchnic system, central vertigo (bulbar, cerebral, cerebellar), a common pathogeny may be referred to. Is it necessary to recall the congestive vasomotor disorders<sup>3</sup> in the disease of the cerebro-medullar axis, on the level of the paralyzed limbs? (Rising of local temperature, exaggeration of sudoral secretion, ecchymosis, edema, etc. \* \* \*).

It is the same if we consider the endocrine disorders, which seem to be at the base of the diatheses, and the connections of the sympathetic system with these glands.

I wonder if vertigo, due to menopause, chlorosis, Basedow's disease, arthritis and gout, etc., is not a congestive vertigo through

active or passive vasomotor disorders, dependent on injuries of internal secretion glands?

To use again a topical word of Bonnier, as well as there is a "epistaxis of the labyrinth," there must be vasomotor disorders of the vestibular membrane as well as disorders of the nasal mucosa, depending on the same causes, revealing the same effects.

This interpretation seems still more exact if we ponder over the *kind of phenomena associated with the vertiginous sensation*. No need to endeavor like Bonnier<sup>4</sup> to explain these phenomena, through the existence of a central clavier with multiple nuclear irradiations.

These *phenomena are essentially those of the vagotonic or the sympathetic tonic system*, with a labyrinthine starting point; that is to say, of the same kind and in the same sphere as the labyrinthine phenomenon itself.

Disorders essentially associated with vertigo are nausea, vomiting, perspirations, mydriasis, and vasomotor disorders. We may compare these phenomena of irritation, which accompany the labyrinthine vertiginous sensation, with the phenomena of intestinal irritation which accompany this painful sensation. Here, as there, we find nausea, vomiting, vasomotor disorders (diarrhea), and mydriasis.

When the starting point of the vasomotor reflex is in the region of the vagous nerve, one may often find associated with vertigo, the symptoms which I have described under the name of *neuralgia of the vagous nerve*<sup>5</sup> (pharyngeal pain or real agony, dryness of the throat or exaggerated salivation, spontaneous and provoked pains at the level of the thyroid wing, corresponding otalgia, thoracic oppression or pseudo-asthma, a dry cough or fits of coughing, cardiac instability, etc. \* \* \*).

Finally, are not the very nature of vertigo, its fugacity, its variability, the brusqueness of its appearance and disappearance, the very characteristics of sympathetic disorders?

We must acknowledge that we have no properly settled opinion as yet, upon the reciprocal action of the labyrinthine congestion and labyrinthine ischemia on vertigo. We have no settled opinion either upon the connections of the labyrinthine congestion or labyrinthine ischemia with the general arterial tension on the one hand, and the tension of the endolymphatic liquid on the other.

With regard to the first point (action of congestion and ischemia upon vertigo), the above considerations incline me to believe that the phenomenon of irritation at the base of vertigo, may rather be more

likely attributed to a congestive processus. But it does not seem proved *a priori* that ischemia is not capable of sometimes producing a momentary painful hyperesthesia, therefore, a transitory hyper-excitability of the vestibular nerve. With regard to the second point (connections between congestion or ischemia and general arterial tension), questions must be asked which are of an immediate interest to the therapist.

Is congestion a cause of hypotension?

Is ischemia a cause of hypertension?

To speak only of the kind of vertigo called vertigo of "hypertended arteriosclerous patients," which has been investigated so well by Escat,<sup>6</sup> one may wonder whether hypertension is a cause of ischemia through the spasm of the internal auditory artery, and whether another kind of local pressure modifications or of toxic irritation of the vestibular nerve is not the matter? The laws of the physiology of capillaries show that whenever the vascular resistance is increased, the general arterial tension is stronger, but the capillary tension is weaker.

Mr. Lermoyez's patients suffering from angospasm have no hypertension, and it is the raising of the vascular dam which brings about vertigo.

Vertigo due to acute anemia (as a consequence of great hemorrhages, abundant diarrhea, depressive nervousism, etc. \* \* \*), is a vertigo due to hypotension, by stoppage of the vasomotor tonic activity at the level of the capillaries, or in other words, through stasis.

So, in our present knowledge of the vaso-tonic equilibrium of the capillaries, we cannot consider vertigo due to hypotension in acute anemia as an ischemic vertigo, no more can we look upon the vertigo due to hypertension as an ischemic vertigo either.

Instability of the vasomotor system or the remarkable variability of its effects from one moment to another, show how difficult it is to discover a hard and fast rule in the connections between the congestion or the ischemia and the general arterial tension.

The rupture of the capillary equilibrium is, whatever happens, the only phenomenon to be remembered at the source of vertigo. This rupture seems to be most of the time a stasis.

The exclusively vascular effect of adrenalin, the successful results of its action that we know much better now (action on the whole of the sympathetic system, more than on the general arterial tension itself), seem to confirm this opinion.

Is it possible to determine the connections between the capillary circulation and the endolymphatic tension with more precision? Must the increase of the tension of the endolymphatic liquid be considered as a disorder connected with the capillary stasis, as it is so with edema in the peripheral stasis?

The favorable results of the lumbar paracentesis (Babinski), and of the trephining of the posterior floor (Aboulker), in the treatment of some types of vertigo, being alone taken in consideration, it is right to think that the pressure of the endolymphatic liquid has been diminished by this way of proceeding and through it, vertigo. But it is not proved that hypertension of the endolymphatic liquid may be considered as synonymous with vascular hypertension. It has been attempted to explain, through the hypertension of the endolymphatic liquid, the vertigo secondary to all causes of distension of the middle ear or of the increase of the air pressure from the duct, and vertigo due to the suppression of the channels of escape or of communication of the endolymphatic cavities (Lannois, Politzer). It is perhaps right to see in such cases an irritating spine, bringing about a reflex vasodilatation and through it vertigo, at the same time, as the associated sympathetic phenomena.

Looking through the multitude of patronized medicines in vertigo treatment, if I never met with adrenalin, I have, on the contrary, been struck, as many of us, I suppose, by the empiric character of most of these medications.

Before going any further, I hasten to add that among the numberless causes of vertigo, a great many are improved by a causal and radical treatment, the excellence of which can never be praised enough.

As an otologist, how could I not quote as an example, the classical removal of a cerumen plug, the evacuation of an auricular flow in the immediate treatment of vertigo produced by these diseases? In another order of ideas, who does not know vertigo that yields to the expulsion of a *tenia* of which it was often the most striking symptom, and vertigo yielding to the lumbar paracentesis? The otologist, most of the time, should be called upon to discern the real cause of vertigo; it is well known that labyrinthine reactions, are of a priceless value in the interpretation of this symptom.

Therefore, there may be as many modalities of causal treatment to be recommended as there are causes themselves.

But all these elementary means of curability put apart, when we are powerless face to face with the phenomenon so paradoxal

sometimes, so striking always that vertigo is without any obvious material cause, when we are, in presence of the numerous vasometer cases of which vertigo is the forerunner, we are compelled to stop its way directly, through a suitable medication.

Most methods brought forward recur to sedative hypnotic or non-intoxicative medications.

Few are those who endeavor to penetrate the intimate mechanism of vertigo, with the purpose of fighting it. Nevertheless, the non-intoxicative medications must be remembered, and I will simply recall to mind the so favorable effect of sulphate of sodium, as well as hydric and lacteal diet in the treatment applied to some vertiginous patients.

I acknowledge that the classical quinin medication has given satisfactory results in the case of vertigo, since Charcot made use of it, but it is at the price of the utter deprivation of hearing, the inevitable result of the total destruction of the exitability of the nerve.

Who does not know the so painful increase for the patient of tinnitus and vertigo in the first weeks at the beginning of the quinin medication? Who overlooks the gravity of a mutilation as the one toward which tends such a medication? All this becomes singularly clear, now that we know better the so remarkable antagonism between the vasotonic properties of adrenalin and the hypotensive properties of quinin. It is right to make comparisons between the quinic vertigo and the vertigo and tinnitus consecutive to the treatment by soda-salicylate and opium, the hypotensive effect of which is the very same.

Vertigo being finally the subjective manifestation of a labyrinthine vasotonic kind, adrenalin seems to be for the time being, the medication which answers best that sort of desequilibrium.

Adrenalin has, in fact, three sorts of properties: elective excitation of the endings of the sympathetic nervous system, regularization of the blood pressure, and antitoxic function.

There would be much to be said about the second of these properties, and I know full well that, to Lewandowsky, L. Camus, J. L. Langlois<sup>8</sup> "the action of the suprarenal capsula on the blood pressure, instead of being continuous, might be only eventual." Adrenalin itself, might not be the main element in suprarenal capsula; and we do not know exactly whether every vascular regions are, to the same extent, sensible to the action of adrenalin. We are, therefore, obliged to stop at the favorable results of this medication on the labyrinthine vasomotor disorder, but on acknowl-

edging, nevertheless, our uncertainty as to the action of adrenalin upon the general blood pressure.

With regard to the antitoxic function,<sup>9</sup> the future will tell us the true connections which exist between adrenalin, the hormone of the sympathetic system, and the diseases due to auto intoxication. We have alluded to the closer and closer connections that exists between diatheses, endocrine disorders and vertigo.

For these last four years, I have treated many vertiginous patients through adrenalin, after other medications had failed. Among these patients, some were greatly affected with vertigo of the Ménière's<sup>10</sup> pseudo type, and others with single giddiness, slight dazzling, more or less concealed among many symptoms of greater importance.

To relate here these observations would be either too long or too short. There exist, in fact, as many varieties of vertiginous symptoms as these are causes of vertigo. I, besides, intend to publish some of them at the same time with a future study on the neuralgia of the pneumogastric nerve. In fact, if adrenalin acts electively upon vertigo, it is sometimes necessary to complete its action with pilocarpin or with whatever vagotonic medication the sympathetic desequilibrium being often nothing else but the sign of a vagotonic desequilibrium.

Till now, I have employed adrenalin as a solution at  $1/1000m$ , by the mouth, this manner being recognized as the most harmless one. Doses have varied, according to cases, from 5 drops to 20 drops, twice a day, taking as a basis the rules laid till now, by most authors,<sup>11</sup> for the administering of this medicinal substance.

It is for this reason that the general arterial tension has been examined before and after the treatment, every time it was possible to do so. With one of my female patients<sup>12</sup> affected with violent vertigo accompanied with vomiting, who had been obliged to take to her bed immediately (things turning around from left to right, even in bed, and the patient having had a fall on the right), the general arterial tension remained for about eight days at the average figure of  $M=12$ ,  $m=8$ . The disappearance of vertigo, through the very rapid effect of adrenalin, was followed only a few days later with the change:  $M=14$ , and  $m=9$ , 5.

With another of my female patients who had been affected for several months with violent vertigo, the maxima and minima general arterial tension remained without any noticeable fluctuations during the treatment. Nevertheless, a slight raising took place as soon as the recovery had been reached.

Such has not always been the case. Most of the patients did not produce a high average pressure and the medication was not followed with a noticeable change of pressure. Generally, in a great many cases, a few days have been sufficient to bring about the complete disappearance of vertigo. This medication is interrupted every ten days, to avoid the intoxicating accidents, the resumed, going progressively from smaller to greater doses.

I have not been able to notice any favorable effect upon rather ancient tinnitus, very likely due to already old injuries, to the cochlear nerve.

To conclude: it seems possible to give the therapeutic of vertigo a new endocrine orientation. The adrenalin medication is, of course, still an imperfect element, but much fuller of promise than whatever medications which have been in use until now. It is in such a frame of mind that I have written these lines and brought forth these results.

1. LERMOYEZ, M.: "Le vertigo qui fait entendre" (angio spasme labyrinthique), *La Presse Medicale*, Janvier, 1919.

2. It is well to remind the favorable action obtained on the labyrinthine congestion by ice applied locally, leeches, ergotin, parasyntesis, tepid washings, and intestinal derivatives.

3. Whether we consider the vaso-dilatation, or Vulpian's words (*Lecons sur l'appareil vaso-moteur*, Baillière, 1875), the "stoppage of the tonic activity of the vaso-motor centres," Vulpian recalls that he has seen and pointed out at the *Societe de Biologie*, that the mucous membrane of the nasal fossa of the frontal and maxillary sinus may produce, on the opposite side of a central injury, a certain amount of a very manifest congestion after death.

4. BONNIER, P.: "Le vertige." Masson, 1904.

5. VERNET, MAURICE: "La paralysie du pneumogastrique," *Paris medical*, 10 Mars, 1917. "Les troubles respiratoires dans la neuralgie du pneumogastrique," *Bull. et Mem. Soc. med. des Hop.*, Paris, 21 Décembre, 1917.

6. ESCAT: "Artériosclérose du labyrinthe et des centres acoustiques (revue anatomo clinique et thérapeutique)," *Annales des maladies de l'oreille*, Avril, 1906, No. 4, p. 325 à 374.

8. Quoted by Mr. Gley in his "Lecons sur les sécrétions internes." Paris. Baillière, 1920.

9. MARIE, A.: "Du mode d'action de l'adrénaline sur les toxines microbiennes." *Ann. Institut Pasteur*, Oct., 1913.

10. Voir Lannois et Chavanne, "Formes cliniques du syndrome de Ménière," *Ann. des maladies de l'oreille*, 1908, Nos. 5 et 6.

11. YOSUE: "Emploi de l'adrénaline en thérapeutique." *Soc. med. des Hop.*, Paris, 22 Decembre, 1905.

12. Vertigo and vomiting were accompanied with slight deafness and feeble tinnitus on the left side. Deafness and tinnitus yielded rapidly; a frontal and occipital cephalalgia existed equally on the left side, during all the time that the patient lay in bed (5 or 6 days), and that improved on parallel lines with vertigo. Labyrinthine reactions have become normal again after 8 days of treatment through adrenalin, the feeling of congestion "of compression" of the ear had disappeared. The ear was "fresher and slighter."

## **EXTERNAL NASAL DEFORMITIES: DESCRIPTION OF THE OPERATIVE TECHNIC OF A NEW METHOD FOR THE CORRECTION OF CERTAIN TYPES.\***

DR. J. D. LEWIS, Minneapolis.

The surgical procedures hitherto proposed for the correction of saddle nose and tip irregularities, while commendable endeavors, have not yielded wholly satisfactory results as measured by the highest ideals of cosmetic achievement, because of the disfiguring scar produced when an external incision is made.

To overcome this undesirable feature the endonasal route has been proposed. This imposes a somewhat more complicated technic and does not fully insure against ultimate displacement of an implant or a transplant. Furthermore, the danger of infection is increased. For these reasons it is not likely that the procedure will be viewed as a wholly dependable substitute.

These important factors are brought under review, not with the intention of discrediting the valuable contributions of my co-workers in this field, but as a basis for comparison with the proposed method herein described:

*Preparation:* Preliminary to disinfecting the skin, the anterior portion of the nasal mucosa is swabbed with a 10 per cent solution of cocaine and the nasal vestibules tightly packed with cotton. The skin of the nose, upper lip, and a part of the cheeks and forehead are sterilized with McDonald's solution. The nasal packs also are moistened with the same solution. The head and face are covered with a moist sterile towel, through which an opening is made to expose the nose.

*Anesthesia:* Circumferential infiltration anesthesia is wholly adequate for this operation, and has several advantages over ether.

About one-half ounce of a one-half per cent novocain solution, to which five drops of epinephrin have been added, is injected at the points indicated in Fig. 1. Complete anesthesia of the field results.

*Technic:* A superficial vertical incision about one-half inch long is made in the midline of the lower half of the columna nasi (a, Figs. 2 and 3) and the lips undermined laterally. Stevens' curved

\*In a subsequent article, case reports of nasal deformities corrected by the method herein proposed and a comparison of the values of celluloid implants and autogenous transplants, will be presented.

eye scissors are then introduced in a vertical direction, between the lips of the initial incision, and the tissues of the tip of the nose undermined by upward cuts, thus converting the nasal tip into a hood. (b, Figs. 2 and 3). The undercutting of the tip should be about one-eighth of an inch beneath the skin surface to provide strong support for the implant or transplant and thereby prevent extrusion, which otherwise may result from forward displacement.



Fig. 1.

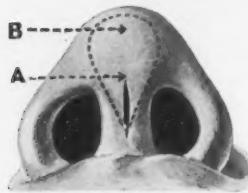


Fig. 2.

The pocket which is to receive the implant or transplant is made by elevating the hood on the same scissors, introduced on the flat, and cutting transversely beneath the subcutaneous tissues toward the nasal bones. During the progress of the scissors along the dorsum of the nose, it is imperative to avoid buttonholing the skin or, likewise, entering the nasal chambers by cutting too deeply into the subjacent tissues. Obviously, to secure results of permanent value, the tunnel must needs be exactly in the midline, otherwise,

whatever may be introduced into the pocket, will subsequently become displaced laterally. It is now a simple matter to insert an implant or transplant, the proximal end of which becomes covered

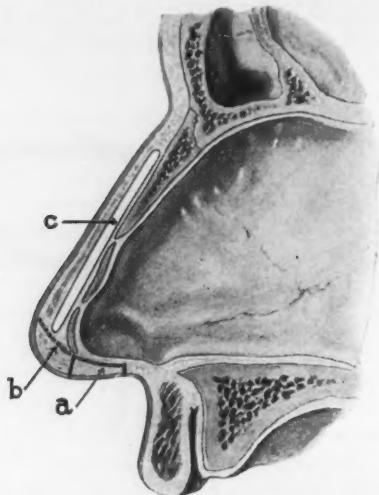


Fig. 3



Fig. 4

by the hooded tip. The incision is closed with three interrupted fine dermal sutures and covered with a coating of compound tincture of benzoin. A small patch of gauze is placed over the base of the nose and held in position by a strip of half inch adhesive

tape carried over the sides of the nose. The stitches are removed on the third day and the dressings discontinued.

#### SUMMARY.

1. The proposed method seems to be based on sound anatomical, surgical and cosmetic principles.
2. The tip-hood provides adequate support for implant or transplant and thereby eliminates danger of extrusion; moreover, the sutures are well removed from the pocket.
3. By this method the nose is accessible to ready manipulation, thus simplifying the technic, minimizing trauma and facilitating the introduction of implant or transplant.
4. The procedure being confined to the midline of the nose, only the terminal blood vessels are wounded, therefore, the field is free from annoying hemorrhage.
5. Owing to the fact that the blood supply is not impaired and the field readily amenable to sterilization, the danger of infection may be almost wholly disregarded.
6. The small external incision promptly heals without leaving a visible scar.

LaSalle Building.

## RHINOPHYMA; REPORT OF A CASE.

DR. SIDNEY ISRAEL, Houston, Texas.

Rhinophyma, the third or advanced stage of acne rosacea, often results in extreme disfigurement.

There is soft tissue hypertrophy of the nose when the involvement is extensive, extending upward from the tip and alae gradually losing itself in the skin above the bony and cartilaginous junction over the dorsum of the nose. This hypertrophy may appear nodular or lobular in character.

The glandular orifices of the skin in this region are large, with enlargement and varicosity of the superficial blood vessels of the



Rhinophyma—Before Operation.



Rhinophyma—After Operation.

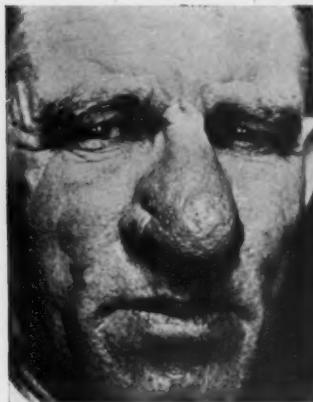
skin, which are readily recognized. Here and there, one might see minute areas of hemorrhages having taken place as the result of rupture of one of these small varicose vessels, either produced by exposure or irritation. In extensive cases of rhinophyma, we find a lobulated appearance of the tip of the nose. The color of this hypertrophied disturbance of the nose varies from deep red to a reddish purple.

The following case, which has recently come under our observation, demonstrates quite clearly the deformity above described, showing the nodular appearance in various localities, with a begin-

ning lobulation. The lesion extends upward from the tip and alae over the dorsum of the nose to a point approximately one-fourth of an inch above the bony and cartilaginous junction.

The patient sought relief on account of the fact that he was becoming more and more conscious of the increasing size of his nose, together with some slight interference during the taking of liquids.

*Operation:* Under general anesthetic, the skin and hypertrophied tissue was removed over the dorsum of the nose and laterally, the



Rhinophyma—Before Operation.



Rhinophyma—After Operation.

nose being bared, practically to the cartilaginous framework. Bleeding was profuse, but promptly controlled by hot saline solution, paraffine gauze was applied over the raw surface. Skin grafting was contemplated as the next step after granulation had begun, but epithelization was so rapid and complete, that it never became necessary.

The following pictures show the patient's deformity before operation, and the results obtained are of interest.

403-4-5 Carter Building.

## ANTERIOR RHINITIS SICCA: ITS ORIGIN AND CURE.

DR. FRANKLIN HAZLEHURST, Baltimore, Md.

Anterior rhinitis sicca is well known clinically to all rhinologists and to general practitioners in the habit of using the nasal speculum, though perhaps, not so generally known under the title just read. It occurs so often that one may find it easily in more than 50 per cent of noses examined in a routine way. In many cases it is so mild in extent and in its effects as to produce practically no discomfort; at other times, so severe as to cause annoying crusting, soreness, nasal obstruction, even alarming nasal hemorrhage. On the basis of this condition frequently arise septal perforation and the so-called "bleeding polyp," source of many cases of nasal hemorrhage.

Parker and Pegler<sup>4</sup> throw an interesting light on the close causal relationship of anterior rhinitis and bleeding polyp, in their contribution of two cases of bleeding polyp in which anterior rhinitis sicca preceded tumor formation. Koerner<sup>5</sup> described a case in which perforation followed rhinitis sicca, Sasadatelew<sup>6</sup>, a perforation occurring in front of a bleeding polyp.

Emil Glas<sup>1</sup> concluded from the study of ten cases of septal polyp that the polyps arise as the result of an inflammatory reaction which, while causing atrophy of the glandular elements of the mucosa, produces a richly vascular connective tissue, which, if the vascularity were greatly developed, might be termed an angioma. He concluded, also, that with more advanced atrophy of the mucosa, perforation of the septum was apt to occur. Schifflers<sup>2</sup>, as early as 1894, advanced the view that the perforating septal ulcer is the result of thrombosis of the nutrient vessels.

Muller<sup>7</sup>, Trautmann<sup>8</sup>, and Nakamura described septal polyps from a microscopic standpoint. Of five cases reported by these men, three were highly vascular fibromata, and two, granulation tissue.

McKenzie<sup>9</sup>, found giant cells at the edges of some perforations. As there is no suggestion in his report that the cases were either syphilitic or tuberculous, it may be that these were foreign body giant cells.

Clinically, on examination, one finds a greater or less amount of crusted secretion on the anterior inferior portion of the septum,

just within the vestibule. If the crusting be absent in whole or in part over the affected area, an excoriation of the mucosa, evidence of recent nosebleed (little areas of hemorrhagic extravasation), more or less scarring of the mucosa, perhaps small areas with actual loss of epithelial covering with granulations growing up from the denuded areas may be perceived. At times the mucosa may present the appearance of a healed scar, showing none of its normal pinkish red color, or that extreme result of atrophy of the mucosa and cartilage, a septal perforation.

Above, are a few notes describing the appearance, microscopic and gross, of anterior rhinitis sicca and the allied conditions, bleeding septal polyp and septal perforation. The purpose of this paper is to present my view of the fundamental cause of these lesions, which I believe to be a mechanical one.

Several years ago, I was struck with the great frequency with which patients complained of a crusting on the septum, just within the nose, very variable in degree, and with the fact that nose bleed cases where the bleeding occurred from this area, (the common site of spontaneous nasal hemorrhage), almost without exception, suffered from this crust formation, although it might be in very slight degree. In noting this crusted or excoriated area in hundreds of cases, it finally dawned upon me that there is always to be found back of such an area a septal prominence, a spur or a deflection of the septum. This spur acts as a barrier to the usual action of the air current in removing secretion. In the passage of the secretion through the nose, a certain amount of it is deposited upon the mucosal surface just in front of this septal prominence and sheltered from further expulsive air currents, dries in this position. Repeated deposits in the same way form a crust. After the accumulation has assumed a sufficient size to attract the attention of the owner, he is apt to dislodge it with the finger tip. Such forcible removal naturally injures or tears the mucous membrane slightly and if frequently repeated, will lead to a definite anterior rhinitis sicca. It is easily seen how readily bleeding can arise from an area of mucosa inflamed or ulcerated from the frequent trauma of removing very tenacious crusts by means of the finger nail—the usual method. Also, how readily the congested vessels of such an area are ruptured by a violent blowing of the nose, scratching with the finger tip or the sharp edge of a passing crust.

If one accept the mechanical theory for the origin of anterior rhinitis sicca and its allied conditions, namely, the presence of a

septal spur or prominence, removal of the deformity at once suggests itself as the logical first step in therapy. With the source of repeated irritation removed, more rapid healing of the lesion would naturally follow.

With a view to testing this theory, I have operated on six patients with entirely confirmatory results. To anyone wishing to convince himself of the value of operation in curing this often very troublesome condition, by doing the operation himself, I would say that to get a good result, the septal wall should be made as straight and flat as possible. To this end, one must avoid any fold of mucosa such as is apt to occur where the mucous membrane is redundant, having previously covered the septal spur or prominence. In such a case naturally the submucous removal of the deformity must be supplemented by removal of the excess amount of mucosa.

Operation in this condition may also be done where there is recurrent nasal hemorrhage arising from this septal area in order here as well to obviate the fundamental cause.

While only a small number of the patients having this condition require operation, I hope the operative treatment suggested in this paper will be found useful by other workers in this field.

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904 N. Charles St.

## GRINDING THE TEETH A PRETTY SURE SYMPTOM OF ADENOID GROWTHS.

DR. C. E. BENJAMINS, Utrecht, Holland.

Some years ago, I drew the attention to grinding the teeth as a pretty sure symptom of adenoid growths.\* As it may be interesting to the specialist, for rhino-laringology, as well as to the neurologist and general practitioner, to get familiar with the most common cause of this often so troublesome symptom, I take the liberty of offering a brief report to this monthly journal of my fureser experience in this matter.

In olden times, grinding the teeth was regarded as a symptom of different diseases, connected with an impairment or loss of consciousness, such as meningitis, uremia, high fever, etc. Also, it is provoked by strong emotions, such as rage, and even in this regard it has a biblical renown.

It is, however, a different thing when the symptoms occurs in full health, and strong emotions are lacking. I hope to show in the following lines the connection between adenoid growths and grinding the teeth in this condition. To prove this, it is necessary that the symptom is often found associated with adenoids, that it generally disappears after removal of the growths and scarcely ever occurs when the same is absent.

On inquiry, I met the same difficulties as so many doctors have, who have to depend on data provided by parents or relations. About the patients of the outdoor department, it is especially difficult to get exact information. So, I had to content myself with a rather small number of cases, as every case that left some doubt about the exactness of the statement was eliminated.

*I. Frequency of Grinding the Teeth in Adenoid-Sufferers.*  
Through the kindness of the following colleagues: Prof. Schutter, Prof. Kan, Dr. Boonakker, Dr. de Kleyn, Dr. van Rossem and Dr. Weyers, I was able to add a number of 600 cases to my own experiences, and in this way, I can report upon 2395 cases of adenoid growths. Grinding the teeth was mentioned in 801 cases, or 33.4 per cent (in an earlier statistic, I got a number of 34.1 per cent, and from my own cases, 34.5 per cent). To understand the significa-

\*Nederlandsch Tijdschrift voor Geneeskunde, 1915, II, p. 570; Ibid, 1917, I, p. 445. Zeitschrift fur Ohrenheilkunde, Vol. 73, p. 151; Ibid, Vol. 74, p. 173.

tion of this number, I made an inquiry into five more symptoms, such as snoring, impaired hearing, catarrh of the upper air passages, aprosexia and enuresis.

On the total of 1791 of my own cases I found: Snoring, 1085 times or 60.5 per cent; Impairment of hearing, 908 times or 50.6 per cent; Catarrh of the upper airpassages, 873 times or 48.7 per cent; Grinding the teeth, 618 times or 34.5 per cent; Aprosexia, 566 times or 31.6 per cent; Enuresis, 462 times or 25.7 per cent.

From these facts, it will be seen that grinding the teeth occurs in about a third part of the adenoid-cases and, in regard to frequency, takes the fourth place.

*II. Does Grinding the Teeth Disappear After the Removal of Adenoid Growth?* I used to tell my patients to come back at least a month after the operation, in order to know whether the symptom had disappeared or not. It is a pity that so many of the patients of the outdoor department did not return, or came back with an escort unable to give proper information. On the whole, I could get exact post-operative information upon 271 cases of adenoids with grinding the teeth. Of these, 219 got rid of the symptom, 24 improved, and 28 did not derive any benefit.

As we may experience with other symptoms, the operation does not always have a good result. *The great number of positive results, however, are conclusive for the connection between adenoids and grinding the teeth.*

*III. What is the Frequency of Grinding the Teeth in Children Not Suffering from Adenoid Growths?* This question is of the greatest importance for the value of our symptom. To answer this question, I have followed two modes of inquiry. (a) First of all, I investigated how many teeth-grinders there were among a certain number of school children. Should that number be greater than we expect, so our symptom would not have much value for the diagnosis of adenoid-growths. (b) Secondly, I examined a certain number of school children, of whom it was known that they were teeth-grinders, in order to ascertain whether the growth was present.

(a) *School Inquiry.* Through the kindness of the medical inspector and teachers, I gained information about 2400 school children. Of 746 of them the data was not clear enough, so I could only make use of the remaining 1654 cases. Of those, 225 were grinders, *i. e.*, 13.6 per cent. What number could we expect, if grinding the teeth was only due to adenoids? From the larger

statistics, we know that about 30.2 per cent of the school children have a hyperstrophy of the naso-pharyngeal tonsil. During my work in Utrecht, I found a number of 36.8 per cent of teeth grinders; *ergo*, we may expect, in the school children of Utrecht, a number of  $30.2 \times 36.8 \div 100 = 11$  per cent grind their teeth by the presence of adenoids.

The figure of 13.6 per cent, we found, comes near to what we expected from the former calculation. It is somewhat greater, because the symptom occurs in the majority of cases in children, from six to eleven years of age, while my general figures were gotten from older and younger persons too, and therefore must be smaller. In any case, it is evident that it is not probable that grinding the teeth often occurs without the presence of adenoid growths.

(b) *Examinations of 115 School Children Known to be Teeth-Grinders.* It was only known of those that they had a habit of grinding their teeth, and for the rest, were in good health. Of this number, *only two* were free from hypertrophy of the naso-pharyngeal tonsil. This result tallies with my former experience, in which I found only three patients, who were teeth-grinders without having adenoids. *This confirms the value of the symptom for the diagnosis of adenoid.*

*Conclusions:* (1) Grinding the teeth is a common symptom of adenoid growths; (2) The symptom is very rare in children not suffering from adenoids; (3) Grinding the teeth takes first place in adenoid-symptoms.

*IV. Some Details About Grinding the Teeth.* The symptom is, like other sequelae of adenoids, most clearly observable during sleep, thus during the night. But it also may be noticed in the day-time. My records show 17 such cases. Probably it is in connection with a state of dullness, in which the reflexes are not inhibited, the same as during sleep.

I had the opportunity of seeing the mechanism of the grinding in a few little patients. The teeth were moved to and fro, either the upper canine on the next incisor of the lower jaw, or two opposite canines on each other. It may be worth mentioning, that now and then, very distinct grooves caused by grinding may be observed (Fig. 1). Some dentists have asserted that grinding the teeth might be a sequel of defective occlusion or bad teeth; this, however, cannot be right, as so many children, with normal or not yet fully developed teeth, gnash them, and moreover, the symptom

disappears directly after the removal of the growths, though the teeth have not changed. Two babies of ten and twelve months old, showed that grinding the teeth may occur already at such an early age. Each of them had four little teeth in both jaws and they moved them, making an extraordinary cracking noise. The eldest patient with the symptom was 21 years old. Among the older teeth-grinders, there were some who had only a small naso-pharyngeal tonsil left. As after operation, the symptom does not always disappear, so the natural involution of the hyper-trophic tonsil, does not always stop the grining, which may continue, together with other more serious sequelae of the former disease. On the other hand, adenoid-sufferers may be met, who lost the symptom together, with others at a certain age.

As to the nature of our symptom, it differs much according to the degree of development. It may have a soft character, but on the other hand it may be heard as a loud cracking noise, and all the



Fig 1.

modulations between. Often the child's parents remark upon this disagreeable habit, it keeps them awake, they say; they call it "awful," "alarming," or compare it to the "gnawing of mice." Though the family doctor is consulted about it, the idea of adenoids, as a cause, is not thought of. A colleague had among his six children, three teeth-grinders, and was very astonished to hear that those three were suspected of being adenoid-sufferers, which was confirmed on examination.

*It is very important to know that grinding the teeth is not seldom the only symptom of adenoid-growth.* I could confirm that fact in 24 cases. I have studied the correlation between our symptom and the size of the growths. In the majority of cases there was found a considerable hypertrophy of the naso-pharyngeal tonsil, in a certain number of cases, however, the symptom was found in connection with a little growth. Thus, the six of the adenoid, though being of influence on the symptom, is not the necessary condition for its apparition. Hypertrophy of the palatine tonsils is of no im-

portance. It occurred 146 times only, in 459 cases of grinding the teeth.

Under which heading the symptom should be considered? It is of no doubt that it should be considered as a *reflex symptom*. The receptive field for the reflex action lies in the naso-pharyngeal mucosa, while the centripetal conductor must be the glosso-pharyngeal nerve or the rami pharyngei of the ganglion spheno-palatinum; the intermediate nerve-units probably lie in the middle brain and the efferent conductor must be the motoric portion of the trigeminus. The presence of adenoid growths is not the only condition for the appearance of the reflex. There must be, also, a certain irritability of the nerve-system, as in other reflectory sequelae of adenoids. Thus, the fact of the diminishing of the symptom being proportionate to the growing up of the children, is to be understood as a consequence of the greater resistance of the nerve-system in the grown-up organism.

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#### PERITONSILLAR ABSCESS AND ITS RADICAL TREATMENT.

DR. W. KENT HUGHES, Melbourne, Australia.

In the April, 1921, number of THE LARYNGOSCOPE, Dr. Heller has a short article on the above. I have practiced this operation for about fifteen years and have never had a fatal result nor any unfavorable sequelae.

At the Melbourne General Hospital, the Childrens' Hospital and in private I have done several hundreds of cases.

Occasionally, great difficulty has been experienced in removing the tonsil completely, especially in those cases where repeated slight attacks of peritonsillitis have occurred over a period of several years. The tonsil, in such instances, is extremely firm and the adhesions are so dense that on two occasions I had to use biting forceps to remove the tonsil after evacuating the abscess. As a rule the operation does not present much difficulty, the tonsil, though firmly adherent to both anterior and posterior pillars, is fairly firm and flattened out. When it is friable, the complete removal is more

difficult and requires both patience and care. I seize the tonsil with an ordinary "blunt" reverse guillotine and strip off the anterior pillar with a pair of long, slender scissors curved on the flat and blunt pointed. After the anterior pillar is lifted off the tonsil, the scissors are passed over the tonsil and opened wide, so as to aid in enucleating the tonsil from its bed. Very often the tonsil is firmly adherent to the posterior pillar along its whole length and has to be cut away with the scissors; the lower lobe is then dealt with in a similar fashion by cutting it loose at the upper part and then passing the scissors under it and finally freeing it. Whereas, while enucleating an ordinary tonsil this part is, as a rule, better performed by pulling the lower lobe from its bed—in peritonsillar cases the tonsil is so brittle that such procedure would be ineffective. If there is any indication to justify the removal of the other tonsil, I always do so. A light general anesthesia is always used, and I never yet experienced any serious results from inspiration of pus. I mop up the pus with swabs during the first stage of the operation. In my opinion, it is infinitely preferable to the old method of opening through the palate with subsequent enucleation at a later date, which is often extremely difficult.

The patient is saved a great deal of pain and time of incapacity. I always at the first indication of any edema of palatal tissue.

I have seen one death from purulent pleurisy and pericarditis two days after the patient had refused an operation at the Melbourne hospital. It was the only time I have ever threatened a patient with immediate fatal consequences. He was getting on to the operating table, and then refused to undergo the operation. As a last resort I said, "Well, you are very foolish, you'll be dead in two days." I don't suppose that had any effect on the course of his illness, but it stopped my career as a prophet.

## UNSUSPECTED FOREIGN BODIES IN THE AIR PASSAGES AND ESOPHAGUS.

DR. C. E. PURCELL, Paducah, Ky.

Ordinarily the symptoms of foreign bodies in the air passages and upper food passages are very pronounced. These, in connection with the history, make the diagnosis comparatively easy. The X-ray must not be left out in considering such a diagnosis. However, in some cases, from the nature and history of the case, we may feel that the X-ray could give no possible aid. This is true in many cases. In some cases of very difficult breathing where X-ray could not be had at once, I resorted to bronchoscopy without waiting for an X-ray picture. The cases reported herewith present some unusual features which may be worthy of consideration.

*Case 1.* A prune seed removed from the esophagus which was unsuspected and which lodged above an esophageal stricture and acted as a valve, thus completely cutting off all communication of even liquid to the stomach.

A boy three years old, while playing about the yard, in the fall of 1919, became very thirsty and hurried into the kitchen to get a drink. There was a cup of concentrated lye on the table and this the child seized and drank. The child had great pain, the mucous membrane in his mouth, pharynx and tonsils was very badly burned and a great deal of sloughing took place.

He was seen and treated by the family physician who applied the usual remedies for such cases, with the result that by the middle of January the child was having a great deal of difficulty in swallowing even liquids. This difficulty increased until the second day of February, 1920, when I saw the child, getting the history heretofore mentioned.

The history and symptoms were so positive of an esophageal stricture that no X-ray was made. The child was sent to the hospital for esophagoscopy and to dilate the stricture. The esophagoscope was passed without any anesthesia, following Dr. Jackson's advice, and a prune seed lying above the stricture was encountered and removed. This was wholly unexpected from the history of the case and symptoms. The esophagoscope was again inserted and a small opening in the stricture was found and a small bougie was passed. Larger bougies were successfully passed and finally the esophagoscope

was gently insinuated beyond the stricture. The child was given a glass of water which he drank without any trouble; later he had several glasses of milk.

Swallowing was still good the following day and we dismissed the child with instructions to return for another esophageal dilation. Fluids were easily passed up to March 8 when I again inserted the esophagoscope and again dilated the stricture, this time to a greater extent than on the first occasion. The child immediately left the hospital, as there was no anesthetic used, with instructions to report in two or three weeks. I have heard from the family physician that the child drinks and eats perfectly well and has no difficulty whatever. I have not seen the child since the 8 day of March, 1920.

*Illustration:* Prune Seed, Figure 1, Case 1. Prune seed removed from the esophagus of a child three years old.

*Comment:* There was no history of a foreign body and the parents did not know the child had had a prune. This seed was lying above the stricture and acted as a valve, thus preventing even fluid into the stomach. This would have been a very excellent case for the X-ray. This foreign body was wholly unsuspected and it occurred to some at the hospital that when we found the prune seed, that that was probably the cause of the inability to swallow. However, the esophagoscope proved that there was also a stricture, which made the dilation of stricture comparatively easy. This case illustrates another point, and that is the value of no anesthesia, as advocated and practiced by Dr. Jackson.

*Case 2:* A root of a tooth accidentally dropped into the bronchus during extraction of teeth under general anesthesia. A woman aged 50.

Mrs. M., age 50, weight 180, had several upper teeth extracted under general anesthesia February 5, 1920, about Ten A. M. The family doctor was called over the telephone about Four P. M. on account of the patient having head ache. Ten grains of aspirin were advised. No more was heard from the patient until the next afternoon, when the family physician was again called to see her. At this time she was complaining of general aching, had a dry hacking cough, temperature slightly elevated, was quite nervous and complained of being unable to rest.

These symptoms grew gradually worse until February 9, when it was thought that she had influenza. Hypnotics and cough sedatives were given freely but with no relief. The patient coughed

a great deal with practically no expectoration. At this time the patient was unable to sleep and the temperature ranged from normal to about 101. On February 10, I was called in consultation in order to determine if there were any focal infection of the sinuses and tonsils. These structures were perfectly normal; however, as the symptoms were suggestive of focal infection, we decided that an X-ray of the sinuses and chest would probably throw some light on the case. As the patient felt unable to be moved at this time, we decided to keep the patient under observation until she was sufficiently able to be moved to the X-ray.

These symptoms continued without relief and without any change until February 25, when another family physician was called in and took charge of the case. From him, I learned that her symp-



Fig. 1



Fig. 3



Fig. 2

Fig. 1 (Case 1). Prune seed removed from the esophagus of a child three years old.

Fig. 2 (Case 2). Photograph of root of tooth expelled during fit of coughing from a lung where it had accidentally dropped during extraction of teeth under general anesthesia.

Fig. 3 (Case 3). Photograph of a small particle of a cedar branch removed from a child's post-nasal space, 5 months old, which had the unusual symptom of gagging.

toms grew worse until March 1, when in a coughing paroxysm she coughed up a root of a tooth. She immediately began expectorating a purulent material, which persisted for a few days. All other symptoms subsided and she made a complete recovery.

*Comment:* This case is unusual from many points of view. The dentist who extracted the teeth was sure he accounted for all teeth and their roots. He could not believe it possible for a root to have been dropped into a bronchus. The symptoms of the patient were very suggestive of a focal infection. It is also probably unusual that a foreign body of this character could be coughed out spontaneously. Having a sojourn of about a month, one would naturally ex-

pect a reaction and such swelling around the foreign body to be sufficient to prevent its expulsion spontaneously. It is interesting to note that the patient made an immediate and prompt recovery after the removal of a foreign body from the bronchus. If the patient had been able to go to the X-ray, we would have been able to locate the foreign body and, no doubt, we would have done a bronchoscopy long before the patient expelled it herself. I regret that I am unable to show an X-ray location of this foreign body in the bronchus. Considering the great number of extraction of teeth under general anesthesia, it is really surprising that more accidents of this nature do not occur. This case was a very perplexing one as there was nothing to indicate that the patient carried the foreign body. The doctor who gave the general anesthetic saw the dentist apparently account for all the teeth and their roots. This root must have been a supernumerary one and was so necrotic that it dropped off in the mouth following the extraction of a tooth and into the patient's lung.

*Case 2, Figure 2:* "Photograph of root of tooth expelled during fit of coughing from a lung where it had accidentally dropped during extraction of teeth under general anesthesia."

*Case 3:* A sprig of cedar removed from an infant's post-nasal space with symptoms suggesting foreign body in the esophagus or pharynx.

A child probably five months old was brought to me in May, 1912, with the history that the child was unable to nurse. The mother said that for several hours previous, that every time the child attempted to nurse there occurred paroxysms of gagging. She did not know if the child had been playing with anything that it could get into its mouth or throat. During the time that she waited for the symptoms to subside there was no improvement. She hastily brought the child to me on Sunday afternoon when I was just ready to go to the country for a drive with my family.

From the history, I thought probably there must be something in the pharynx or esophagus. With a tongue depressor, I looked into its pharynx with negative results. With a small laryngeal speculum I pulled the tongue forward and could see there was no foreign body in the larynx. I looked into each pyriform fossa and there was no evidence of a foreign body.

As the child had no difficulty in breathing and was disturbed only when an attempt at nursing was made, I decided to wait till the following day and get an X-ray picture before making any

further attempts at finding its trouble. An X-ray picture showed no foreign body present anywhere. As the child continued to gag when it attempted to nurse, I decided to do an esophagoscopy for diagnostic purposes. The esophagus was explored and no foreign body found.

The symptoms were so unusual, that at this point, I was quite a bit upset over my not finding the foreign body in the esophagus. In order to clear up the diagnosis, I passed a small bronchoscope into the trachea with no evidence of foreign body. At this particular time it occurred to me that the only place a foreign body could be would be in the post-nasal space, since I had excluded the pharynx, larynx, trachea and esophagus. Pulling the soft palate gently forward with a hook, I could see a foreign body well up in the post-nasal space. This was at once seized with a pair of forceps and gently removed. It proved to be a small particle of a cedar limb, which, no doubt, the child had picked up off the floor and placed in its mouth. Probably, this lodged in the pharynx and during a period of gagging was pushed high up in the post-nasal space where I finally found and removed it.

*Case 3, Figure 3:* Photograph of a small particle of a cedar branch removed from a child's post nasal space, 5 months old, which had the unusual symptoms of gagging.

*Conclusions:* 1. That our limited experience convinces that there are many advantages in the removal of foreign bodies in children without any anesthesia whatever, as Dr. Jackson has many times emphasized.

2. That there is absolutely no danger in doing exploratory esophagoscopy or bronchoscopy if done without anesthesia and very carefully and gently carried out.

3. That in the case of the foreign body, tooth root in the bronchus, that an X-ray would have located the trouble which would have given bronchoscopy a chance to relieve the patient.

## NEW YORK ACADEMY OF MEDICINE.

### SECTION ON OTOTOLOGY.

(Continued from page 162, February issue.)

#### DISCUSSION.

DR. GLOGAU said that he had one case of sinus thrombosis with multiple metastatic abscesses, where transfusion saved the life of the child, that after removal of thrombus and jugulectomy had been given up. In another case, a four-year-old child scratched during the night the exposed sinus. When I was called the child was almost exsanguinated. When Dr. Unger performed the transfusion, the child hardly showed any sign of life. Shortly after the transfusion the child looked remarkably well. It recovered within 3 days.

DR. SEYMOUR OPPENHEIMER said he had had a large opportunity of observing the indications of the necessity for blood transfusion in various otological and rhinological conditions and could testify to its very great value, and also to the wonderful skill with which Dr. Unger employs in the method described this evening. The apparatus works almost automatically and with the assistance of a well-trained assistant it operates in a delightfully simple manner.

Dr. Oppenheimer said he had heard much of the discussion between the exponents of the various methods of blood transfusion, and latterly had come to believe that the method suggested by Dr. Unger of administering the unmodified blood is probably the most ideal one; yet he could see a situation where it was not always practical to employ it, and that experience had occurred to him on several occasions where the donor was rather distant from the recipient and it was not possible to bring them together, but it was practicable to bring the blood from a distant point to the patient; in such cases blood was used to which something had been added as an anticoagulant.

A symptom that had struck him rather forcibly in a blood transfusion was the indication which seemed to be almost absolute when an overdose was about being reached. It is for us rather difficult to estimate just how much blood should be used, and that as well as the selection of the donor and other laboratory tests must be left to the men engaged in this class of work; but the symptom referred to is the occurrence of a slight cough when the dose of tolerance of blood was reached. Perhaps Dr. Unger might refer to this later. He himself had observed it repeatedly. Where an excessive amount of blood is being given, the patient gives this cough, which is an indication that no more should be administered. There is on record a statement by a man engaged in this work that in several instances where this waning cough has been disregarded a fatal issue has resulted.

One other point, the question of the disappearance of the bacteria in the blood stream after the administration of a quantity of blood by transfusion—that might lead to error. Starting with a positive blood culture, the blood stream may become free of bacteria after the administration of the blood, and in making a subsequent culture of the blood it may be negative; and still later the culture may be positive, evidently the continued presence of a bacteraemia.

He was not prepared to say that blood transfusion has altered the mortality rate in dealing with these cases, but he could state that it has modified the convalescence of cases and has made the patients more comfortable, so that the convalescence has been freer from many of the stormy incidents that have often followed operations on the large cranial sinuses.

DR. UNGER said he was sorry that Dr. Lewisohn should have made a statement that was not in accordance with the facts, for there was absolutely no connection between the donor and the recipient. That part of the instrument which is connected with the patient is at no time connected with the donor. Another point to which he took objection was Dr. Lewisohn's statement that the statistics relating to the occurrence of chills and fever following citrate transfusions were not correct.

With reference to the value of the whole blood, Dr. Unger said he had admitted that in his first series the plain blood from an ordinary donor was of little or no value. Blood from an ordinary donor will merely support the patient, raise the blood count and keep the patient alive. A few patients recover. If the donor is vaccinated, it is of little or no value; to be of real value, the donor must be immunized.

Dr. Unger said he had very few cases to cite, only about 14, but these warranted the presentation of the facts and the consideration of the changing of the methods now used. Perhaps the next 100 cases would prove the matter.

In regard to the cough which Dr. Oppenheimer spoke of as an indication that a sufficient dose had been given, Dr. Unger said he had described this some time ago. When a sufficient dose has been reached for the patient he will give one little hack, and if you then continue the patient will hack still more, and if you go beyond 200 cc. you will run a great chance of pulmonary edema.

(Diagram showing change of temperature after transfusion from 106.7 down to subnormal and 96; blood culture positive, etc.) If the patient is given blood transfusion from an ordinary donor, the blood culture usually remains positive. If a transfusion from a stock immune donor is given, the temperature ran on a lower plane and the chills stop. The blood culture will remain positive. If you give an autogenous immunized serum, the blood culture becomes negative and the temperature which continues is no longer that of sepsis, but the temperature of a localized abscess somewhere in the body. If this is evacuated it becomes normal and stays normal. One woman developed 12 abscesses, which were opened successively. She was sick for six months.

Finally a slight swelling was observed in the groin, and 800 cc. of pus was evacuated, and when that was done the whole condition cleared up.

#### SECTION ON RHINOLOGY AND LARYNGOLOGY.

December 21, 1921.

**Case of Carcinoma of the Larynx Cured for Seven Years.** DR. Beaman Douglass.

DR. DOUGLASS said that he took much pleasure in presenting this case, for it was rather rare to see a patient alive and well seven years after such an operation. It was the only one he had seen out of many that he had operated upon.

The patient, Mr. M., seven years ago had a tumor of the larynx on the right side, externally and internally, involving the posterior aryepiglottic fold and the posterior, but not the anterior cords. A piece was removed for examination and the pathologist reported the histological characteristics of carcinoma; the cell was discussed and the balance weighed between epithelioma and carcinoma, finally deciding in favor of carcinoma, the cell being endothelial. The patient was operated upon by external thyrotomy and partial laryngectomy, and was fed through tubes for a couple of weeks. He made an uneventful recovery and since then has had no recurrence at any time. He speaks with the usual hoarse voice.

#### DISCUSSION.

DR. IMPERATORI said that this was certainly a case for congratulation, in that the patient was alive, and with no recurrence after seven years.

It was noted that metal clips were used in bringing the thyroid cartilages together after the operation.

Dr. Imperatori doubted the necessity of this procedure; suturing the fascia with heavy chromic gut and the proper skin approximation was sufficient.

DR. COFFIN said that Dr. Lynah has done quite a number of thyrotomies. He does not suture the cartilage at all, nor does he suture the soft parts; in fact, he packs his gauze down to the cartilage, keeping the soft spots separated as much as possible. The wound heals by granulation and in some cases Dr. Coffin had seen them with little evidence of scarring.

**Optic Nerve Involvement Complicating Sphenoidal Sinusitis.** Dr. Beaman Douglass.

This case was interesting in view of the last meeting of the Section in conjunction of the Ophthalmological Section, where was discussed the probable association of the nerve lesion with the sinus lesion.

The patient, Mrs. B., was 28 years of age. Two years ago, after the death of a child, she had a left hemiparesis and left diplopia. This was relieved by a chiropractor. Six months ago it returned in a more severe manner than before—after the receipt of adverse business news—accompanied by dropped eyelid and paresis of the eyeball so that it was immobile. For two weeks she suffered from total blindness of the left eye. A diagnosis of involvement of the optic nerve was made by Dr. Schoenberg, who noted pallor of the optic disc, etc. The Wassermann reaction was negative and the spinal fluid was negative, and he was at a loss to account for the cause of the condition.

She now sees a bar of shadow on the left eye, on the side of the nose, and still has hemiparesis; but no other trouble. Neither the ophthalmological nor the X-ray examination could account for the lesion, and it would seem that the cause must be in the nose, which shows a distinct enlargement of the middle turbinate, etc., etc. The patient is now pregnant, and after her confinement will be operated upon in the hope of curing the blind spot.

**Unusual Case of Tuberculosis of the Larynx.** Dr. Beaman Douglass.

The patient is a man 32 years of age who has been sick for nine months, but has been carrying on his business all that time. A tracheotomy was done some time since and he wears a tube and breathes entirely through it because the larynx is filled up with what seemed to be a growth. The glottis is entirely closed by an adhesive formation resembling a tumor rather than a tuberculous process. The diagnosis was withheld until the X-ray examination revealed tuberculosis of both lungs, in the second stage; then pieces were removed from the growth for examination, and the diagnosis of tuberculosis was twice confirmed.

It is a most unusual case of tuberculosis without ulceration, filling the larynx as a tumor formation rather than as an ulcerative process, and is the only such case in my experience. Two attempts have been made to get through the growth, without success, the tuberculoma being too tough; the patient has refused a thyrotomy, and the only thing now seems to be radium treatment.

DISCUSSION.

DR. COFFIN said that he had been fortunate enough to hear a paper on this subject by Dr. George B. Wood of Philadelphia at the Congress recently held in that city. Dr. Wood is treating laryngeal tuberculosis of all stages by electric cauterization and claims most satisfactory results. From what Dr. Wood said, Dr. Coffin thought the method the best available for Dr. Douglass's case.

DR. DOUGLASS said that the point about the carcinoma case was not the technique employed, which varies from year to year, but the fact that the patient is alive and well at the end of seven years after the clinical diagnosis of carcinoma had been made and confirmed by micro-

scopic examination. He felt that it was a case for congratulation, since he has done a great many laryngectomies and this is the only case he has seen cured after that lapse of time.

He expressed his appreciation in regard to Dr. Freudenthal's suggestion in regard to electro-cautery for the treatment of the tuberculosis case, as he had been somewhat at a loss to know what was best, since the man refused to allow the removal of the tumor. He had thought of radium, and would like to know if any one present had had experience with radium in this condition.

DR. FREUDENTHAL replied that he had had no success with it, although it might have been that he gave up too quick' because he was discouraged, and that he uses the electro-cautery great deal in these cases.

**Present Condition of a Case of Ethmoidal Sinusitis Complicated by Optic Neuritis, Five Years After Cessation of Treatment.** DR. Duncan Macpherson.

(To be published in a subsequent issue of THE LARYNGOSCOPE.)

DISCUSSION.

DR. COFFIN said he was glad that Dr. Macpherson had spoken as he had in regard to the use of negative pressure, as he himself saw much benefit from its use; in fact, said he could not get on without it.

Exhibiting a hand-painted Xmas card, Dr. Coffin said: "Only today I received this card, painted and sent me by a young lady who, less than a year ago, was sent me by one of our leading ophthalmologists, saying he thought the young lady's blindness was due to accessory sinus disease. She was unable to find her way about the room; she was put on negative pressure treatment at once. Improvement began in a very few days and progressed uninterruptedly until she had normal vision and is today making her living as a painter in an art shop. I have not seen her in two or three months. Time is too short to cite other cases."

DR. DOUGLASS said he was one who did not believe in suction treatment.

DR. COFFIN replied that the clinching argument of those who could see no good results except through surgical procedure is: "Oh, well, some of those cases get well without any treatment," and asked if the same argument might not be applied to those cases operated as well.

DR. LEDERMAN said that these cases were too important to be allowed to pass without comment. He had just heard of another case, forty-eight hours ago. The patient, a young man, had been operated on one side for ethmoidal trouble by a colleague. There was no reaction from that side, and the other side was operated upon about a week later. While the second operation was being performed the patient suddenly exclaimed that he could not see with the corresponding eye and was found to be absolutely blind in that eye. No change in the optic disc was noticed after the operation. He was watched for forty-eight hours and showed some meningeal irritation, and died 48 hours later of meningitis. What happened in that case? There must have been a direct involvement (trauma) of the nerve; evidently the operator must have gone through the cells and injured the nerve. This opening up of the ethmoid cells is not a simple thing and should not be resorted to in such a heroic manner. It is not necessary to use a curette in these cases, if the cells are simply opened and drained. Much harm is often done by trying to get out every vestige of the diseased mucous membrane.

DR. IMPERATORI said that Dr. White told him that he rarely did a complete ethmoid operation on these types of cases.

His usual procedure was to remove the middle turbinate and open the ethmoid labyrinth, by uncapping the posterior cells. If results were to be obtained they would manifest themselves within 24 to 36 hours.

DR. DOUGLASS said that, of course, Dr. Coffin might be expected to corroborate everything that was said in favor of suction of the sinuses, since he had invented that method, and doubtless Dr. Coffin was as

prejudiced in its favor as Dr. Douglass was on the other side. Since Dr. Macpherson has asked why Dr. Douglass should object to a method when other men used it and found it satisfactory, he would answer that he might object to a method (and here he was not referring especially to suction, but to a principle) because perhaps he might be ignorant of it, or because he might condemn it in general, or because he could see no good results after he had tried it, or because he thought the claims for it were exaggerated.

Dr. Coffin said that the subject was too serious for jocularity. Certainly all who know him know that he is a frequent operator for ethmoidal disease, his only contention being that not infrequently operation may be avoided by the use of the negative pressure. Dr. Coffin instanced a case that came to his Clinic about six weeks ago. This was a young girl about eleven years of age, who had suffered since October, 1920, from headaches, convulsions, nausea and vomiting. During this year's sickness she had been sent both to Bellvue Hospital and the Neurological Institute for study. When she came to the Manhattan Eye, Ear and Throat Hospital, she looked septic and a bulging at the inner canthus of the eye indicated a rupture from the ethmoids into the orbit. On account of her age and general condition it was decided to do a radical Killian operation. No bed could be had for several days and Dr. Coffin instituted treatment by negative pressure methods. Improvement was so marked and rapid that the case has never come to operation. When first seen six weeks ago her weight was sixty odd pounds; today, she weighs 81 pounds, is rosy and healthy looking, no symptoms of illness and only a small amount of mucous can be gotten from her nose by any method. Such results are convincing and Dr. Coffin feels that they who doubt have not tried the method or do not know how to use it. However, it is not of itself a cure-all.

**Presentation of Cases Showing the Application of the Thiersch Graft to the Walls of the Frontal Sinus, Antrum and Gingival Sulcus.**

Dr. J. Eastman Sheehan.

The first case was one of suppuration of the frontal sinus; the second, one of suppuration of the maxillary sinus with marked polypoid degeneration, necrosis of the roof of the antrum, supplemented by the application of a graft of the Thiersch variety. The third case was one of loss of lower lip repaired by lining the gingival sulcus with a Thiersch graft, externally repaired by a double tube pedicle from the chest.

In the frontal sinus case, Lothrop's technique was followed, whereas in the case of the antrum, Denker's procedure was carried out. By lining the bony walls with skin, one avoids weeks of irrigation and the eternal dripping; the formation of scar tissue is avoided, thereby assuring one of a cure. The method has passed beyond the experimental stage, for Smith, Gillies and myself have treated a number of cases successfully in this way. The application of the graft to the tonsil sulcus is still experimental; we hope later we shall be able to simplify the procedure. The graft is taken from the inner aspect of the right thigh and spread over the entire sinal cavities with one, two or three pieces. It is made adherent to the walls by the use of the Ballance catheter. The external wounds are left open to note how well the grafts have taken. In the case of the frontal sinus the graft is held firmly to the sinus wall by small pledges of cotton attached to strands of twisted silk. The cotton pledges are removed after six days and the cavity as a rule is not irrigated for several days afterwards.

In the case of the antrum the same procedure is carried out, except one can use in preference to the cotton, a small, soft balloon with catheter attachment. This is inserted in the deflated state through the nares and after it is placed in position in the antrum it is inflated to such a degree of tension to assure even and firm pressure. The cotton or balloon is removed after the sixth day.

Various gentlemen present have watched the progress of some of these cases with me at hospitals.

The third case is interesting, for this patient had a total loss of the lower lip; there was no vermillion border. The condition started as an ulcerative process at the third month and continued for six months. It finally healed with an enormous scar, with total loss of vermillion border, no lip function, the muscles being bound down by dense adhesions. The inside of lip was lined with a Thiersch graft, a model of stent was taken of the sulcus, the graft placed around the stent, raw surface outermost and the whole sewn in, the ends of the strands being attached to the teeth. Two attempts to repair the outer covering of lip failed, the third attempted was successful after taking a fresh tube from the left side of the neck and chest. You will note, she now has not only a good looking lip, but a functioning one.

The scar at right inner canthal region was repaired by excising it and applying a Thiersch graft. It was partly successful, as you can see. I purpose later to repair the whole area by a forehead flap.

DR. SHEEHAN said that he wished to impress the importance of this method in radical operations, in order to insure a cure. He had done many operations on the frontal sinuses and antra and had so often been confronted with dripping, and in some cases reinfection; weeks of irrigation was avoided. If the membrane can be replaced in these sinus cavities with true skin the cure is practically secured. What takes place after one performs an antrum or frontal sinus operation? Squamous epithelium and scar tissue is formed, which does not prevent infection. This method is simple, and if applied with proper technique, it will clear up most of the cases promptly after a radical operation. Last year a patient was treated who had been suffering for over five years; he had had three external operations, and always suffered from dripping, and catching cold. He was told that this new method was more or less experimental, but he agreed to try the skin graft. Since then he has been entirely well. The reason these cases are presented before the throat section tonight is to impress upon the men who are operating these cases year in and year out that they are leaving the bone exposed to heal up with scar tissue, which does not insure a cure, does not secure the case from reinfection, does not cure dripping, and finally in many cases it takes months of daily irrigations before the cavity heals, leaving behind dense bands of scar tissue.

#### DISCUSSION.

DR. WHITHAM said he had had opportunity to see one of Dr. Sheehan's maxillary sinus cases treated by this method and the fifth day after the grafts had been put in, the cavity was as clean and nice as could be desired. Every portion of the graft had taken and it looked as though the healing would be rapid.

#### A Report of a Case of Osteoma of the Antrum. DR. T. J. Harris.

H. K., aged 16, presented himself at the Post Graduate Hospital, March, 1921, complaining of a swelling of the right cheek, which had existed for a number of months. The swelling was not painful, and was slow in its growth. Palpation showed a hard symmetrical mass under the right eye, involving the entire external wall of the antrum. Examination of the nose showed no obstruction on the affected side. The roof of the mouth showed no abnormality. Eyesight was normal. There was no history of nasal discharge, and no secretion could be discovered in the nose.

Puncture of internal antrum wall showed thick bone. No penetration at  $\frac{1}{4}$  inch. Free bleeding. No pus.

X-ray showed a complete shadow of right antrum; left antrum normal. Other sinuses normal.

Diagnosis: Osteoma of the antrum.

Caldwell-Luc operation.

On removal of the external wall, the antrum was found almost completely filled by a bony mass of moderate density easily removable with bone curettes and ronguer. The specimen of the fragments removed

was sent to the laboratory for examination and showed "osteoma with purulent inflammation." Subsequent to the operation the patient was given four exposures of radium as follows:

March 7, 1921: Amt. of emanent or emanation, 30 mg., 1 mm. gold, 1 mm. brass; duration of treatment, 15 hrs.; total number Mg. or Mc. hours 450 mg. hrs., applied to antrum.

March 7, 1921: Amt. of element or emanation, 30 mg., 1 mm. gold, 1 m. brass, 1 mm. rubber, 2 cm. towel; duration of treatment, 15 hrs.; total number Mg. or Mc. hours, 900 mg. hrs., right cheek external.

April 19, 1921: Amt. of element or emanation, 25 mg., 1 mm. gold; duration of treatment, 5 hrs.; total number Mg. or Mc. hours, 125 mg. hrs., in antrum. Amt. of element or emanation, 60 mg., 1 mm. gold, 1 mm. brass, 1 mm. rubber, 2 cm. towel; duration of treatment, 3 hrs.; total number Mg. or Mc. hours, 180 mg. hrs., external.

May 17, 1921: Amt. of element or emanation, 25 mg., 30 mg., 1 m. gold, 1 mm. brass, 1 mm. rubber, 2 cm. towel; duration of treatment, 6 hrs., change; q. 2 hrs., 3 spaces; total number Mg. or Mc. hours, 330 mg. hrs., external to cheek.

When last seen, July 7, the swelling of the cheek had virtually disappeared.

*Comment:* Osteoma of the antrum alone is a rare condition. Osteoma originating in the antrum or ethmoid and involving the other sinuses is more common.

We have been unable to find in the American literature, a report of any case of osteoma of antrum alone.

Bornhaupt, in Langenbeck Archiv. fur Medicin, 1881, reports ten cases.

Von Sonnenkall, Zeitschrift fur Ohrenheilkunde, vol. 65, page 19, reports a case of the osteoma of the ethmoid, which by extension filled the antrum. Removal by operation. Recovery.

Botey, in Semons Archivs., 1912 reports a case of nut-sized growth removed by a Caldwell-Luc operation.

Henrich, in Semons Archivs., 1911, page 35, reported before the West German Nose and Throat Society, two cases.

The first case was aged 18. The tear duct and the nose were almost completely obstructed. The bone was hard, the swelling developed inside of a month. There was no pus.

Trans-illumination dark. Denker operation. No antrum cavity found. Entirely filled with soft bone. Prompt recovery.

The second case was aged 17. Slow growing tumor under left eye, close to nose. On operation, it was found that there was an enlargement of the antrum "by a bulging of the facial wall, the result of catarrhal swelling of the mucous membrane of the antrum." In this way developed a bony growth in the region of the Haversian canals.

Finally Philip reported a case before the French Society of Oto-Laryngology, May, 1911. Patient aged 19. Nasal obstruction was first symptom, followed by swelling of the face on the affected side. Operation. Microscopic findings showed an osteoma.

Osteoma is of two kinds: soft and hard. (Ivory.) It usually grows from the median wall. The prognosis is good as far as recurrence after the operation is concerned. Left alone, the tendency is to continue to grow, involving the orbit and the nose.

#### Malignant Epithelioma of Pharynx Treated with Radium. Dr. Max Unger.

Patient, J. B., 60 years, painter by occupation, came to Dr. Harris' Clinic, October 8, 1921, complaining of pain on swallowing hard substances.

*Family History:* Negative.

*Previous History* is interesting. He contracted lues 20 years ago, for which he received no treatment. About 4 years ago he had a gastric hemorrhage and in the routine examination for that condition a positive Wassermann was discovered. He received vigorous anti-luetic treatment for 3 years. His gastric disturbance did not recur and his Wassermann became negative.

*Present History* dates back three weeks before he came to the Clinic. He began to have difficulty and pain on swallowing solid food. Fluids went down easily and painlessly. The pain on swallowing increased, so that he had to take fluids only. There was occasional vomiting of a small amount of fluid. Vomiting had no relation to ingestion of food. Ingested food was never vomited.

*Examination* showed a slight, elderly man, poorly nourished. Physical examination was negative.

*Throat Examination* showed a sessile growth on the back of the pharynx, extending from the level of the soft palate to the upper end of the esophagus, from the right posterior faucial pillar to the left pillar and protruding into the mouth one-half inch.

The center of the growth was excavated and showed an ulcer about  $\frac{3}{4}$  inch in diameter. The ulcer was covered with a grayish slough and showed some hemorrhagic spots.

Wassermann examination was negative.

Tissue examination showed a papilloma with malignant changes.

The diagnosis lay between gumma and malignant growth. In view of the negative Wassermann, the malignant changes seen microscopically and the clinical picture a diagnosis of malignant inoperable neoplasm was made and radium treatment instituted.

Radium treatment was as follows:

Oct. 23—two 60 mg. tubes for 24 hours on the outside of the neck.

Oct. 25—one 60 mg. tube in the pharynx for 4 hours.

Nov. 23—four 5 mg. needles for 4 hours.

Dec. 14—one 60 mg. tube in the pharynx for 4 hours.

The radium treatment had a remarkable influence on the growth from the first application. The growth seemed to melt away. After the third treatment only the ulcer was left. At present, 8 weeks after radium was first used, there is present only an ulcerating surface about  $\frac{3}{4}$  inch in diameter.

#### DISCUSSION.

DR. ROBERTSON said that he saw this case when the patient came to Dr. Willis for treatment. He first received 60 mg. on the outside of the neck, with a layer of glass and lead left in place for 6 hours. This was given to treat the external glands of the neck and passages, and to have some effect on the pharynx itself. Two days later, a 60 mg. tube was placed in the pharynx and the radiation was practically on all sides, for the tube was left in place for four hours. After another month there was a regression of the tumor. Then needles were used, 4.5 mg. needles being inserted into the tumor for four hours. The needles were not used at first, for there was a tendency to infection, which is sometimes worse than the original condition. The last treatment was in December, when a 60 mg. tube was placed in the pharynx for four hours. The patient still showed some effects of the treatment given then.

This case was favorable, for it was accessible, in contradistinction to the growths of the pharynx which are not accessible, and it might be classified under Class C of inoperable cases. Hitherto no cases of tuberculosis of the larynx had been treated at the hospital, but many cases of tuberculous glands of the neck had been treated with good results. This case had shown a remarkable improvement in two months, and it was expected that in two months more there would be very little malignancy remaining. It would have to be followed very carefully to observe any recurrence, and should be treated regularly at intervals.

DR. IMPERATOR said that this seemed to be the proper place for radium treatment, but that he thought Dr. Robinson should revise his ideas as to the use of radium in the larynx. He himself had seen no cases of carcinoma of the larynx cured by radium, though many of the men might think it a favorable place.

DR. ROBERTSON rejoined that he had spoken about carcinoma of the larynx. They had not been successful, for it was not a favorable location and they had not been able to put the needles in the proper place; but in

some instances there had been some improvement, though so far they had not been able to report any cures. This case was favorable, for the growth was situated higher up.

DR. FORRES said that he had recently had under his care a case of naso-pharyngeal growth, left side, and the results were just the same as Dr. Unger reported; but after three or four months there was a recurrence of the growth on the other side of the naso-pharynx. Dr. Green in Boston is using emanations in new growths maxilla and naso-pharynx and while he has not so far cures to report, he feels that he is on the right track and making scientific progress in the way of better applications and hopes to make a full report latter. He has not given up the use of radium in cases of laryngeal new growths nor of new growths of the esophagus.

DR. LEDERMAN reported a case of malignancy of the rhino-pharynx with almost complete occlusion, the patient being barely able to breathe through the nose. The growth was inoperable and the patient, who was sixty years of age, was referred to the Memorial Hospital, where she received one application of radium through the right side of the nose for one hour. A week later it was surprising to see the effect of the radium. Most of the growth had disappeared and one could readily inspect the naso-pharynx; the patient could breathe well and showed only a slight burn on the hard palate. The only question was as to whether the result would be permanent. In the case mentioned by Dr. Forbes the growth returned in three or four months.

DR. DOUGLASS asked if any attempt had been made to split the larynx and then put the radium needles in the growth. In that way one could place the needles where desired.

DR. HARRIS called attention to the fact that the hour was late and that a whole evening had been devoted to this subject last spring. The discussion then was very full and some of the conclusions were that operable cases should be operated; in other words, that not sufficient evidence had been accumulated to justify depending upon radium as a cure where an operation was possible, but that the use of radium before and after operations was very desirable and would do much to prevent recurrence of the growth. At that time he had reported that he had found in the literature reports of eight cases of malignant disease of the larynx treated by radium alone that had remained free from recurrence for three to five years, enough to be encouraging.

DR. LEDERMAN cited a case of sarcoma of the left tonsil in a male forty-five years of age, which after three treatments with radium, looked as though a tonsillectomy had been performed, and healed over very nicely.

(*To be continued.*)

